

# **Preliminary Analysis of Alternative Greenhouse Gas Emission Reduction Strategies for the SBCAG Region**

**(For Submittal to California Air Resources Board)**

**May 6, 2010**

**Santa Barbara County Association of Governments**

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This report was prepared with the assistance of state and federal planning funds

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## Executive Summary

### Introduction

At the request of Air Resources Board (ARB) and as outlined in the report by the Regional Targets Advisory Committee, the 18 Metropolitan Planning Organizations (MPOs) in California agreed to conduct analyses of the Green House Gas (GHG) emissions reduction benefits of various alternative planning scenarios. The purpose of this analysis is to assist ARB staff in developing GHG emission reduction targets by June 30, 2010 as part of the SB-375 implementation.

This analysis was conducted under guidelines developed by ARB and the four largest MPOs in the state. These guidelines placed five general conditions on the analysis:

1. Half of all trips (50%) that travel between MPO boundaries, in our case SBCAG and SLOCOG in the north, and SBCAG and SCAG in the south should be addressed by each MPO;
2. The analysis should separate out the benefits of state in-vehicle emission controls that will phase in over-time with vehicle fleet turnover (i.e., the Pavley / Low Carbon Fuel Standards (LCF) adjustments;
3. The composition of the scenarios and their constituent measures should be standardized to the extent possible;
4. The assessments should be based on existing modeling capabilities from existing data; and
5. Consistent base and forecast years and metrics in data reporting should be used.

This report outlines the assumptions and technical analyses used by SBCAG in conducting three planning scenarios to estimate the GHG emissions reduction for the future 2020 interim and 2035 horizon years. This report contains three major elements:

- Newly updated SBCAG travel forecasts for the 2005 Base Year, 2020 and 2035 for Santa Barbara County, based on the 2007 Regional Growth Forecast (2007RGF)
- Three alternative planning scenarios, including assumptions and methods of analysis
- Preliminary GHG emissions reduction estimates

Each of these scenarios further expands and enhances the implementation of various strategies and policies over-and-above the currently adopted RTP. Similar strategies and policy options are bundled together in order to visualize the potential GHG emissions benefits. The three scenarios are:

Scenario A: Transportation Demand Management (TDM) and Transportation System Management (TSM)  
Scenario B: Transportation System Improvements (TSI) and Land Use  
Scenario C: Pricing and Disincentives

Table ES-1 summarizes overall change in GHG for the 2035 horizon year compared to the 2005 baseline.

**Table ES-1: Baseline Comparison of VMT and GHG production between 2005 and 2035**

Evaluation Criteria (2005 Baseline vs. 2035 Horizon Year)	2005	2035	Increase/ Decrease	% Increase / Reduction
Daily VMT	10,798,464	12,978,263	2,179,799	20.2%
Daily GHG Emissions (Tons) (No Pavley Adj.)	4,643.34	5,515.76	872.42	18.8%
Daily GHG Emissions per Capita (lbs) (No Pavley/LCF Adj.)	22.24	22.62	0.38	1.7%
Daily GHG Emissions per Capita (lbs) (with Pavley Adj.)	22.24	14.62	-7.63	-34.3%

\*Pavley/LCF refers to State mandated in-vehicle emission controls and Low Carbon Fuel use

## Planning Scenario Evaluation

### Scenario A: TDM and TSM Alternative

This scenario combines the expanded TDM measures (rideshare, Individual marketing, and flex work) recommended in the 2007 101 In-Motion report incorporated in the current SBCAG Model plus the additional post processing analyses to estimate GHG emissions reduction benefits. The following summarizes the GHG reduction benefits associated with this Scenario:

- Total daily vehicle trips = 1.658 million, representing a reduction of 5,955 (or 0.36%) daily vehicle trips
- Total daily VMT = 11.313 million, representing a reduction of 128,700 (or 1.1%) total daily VMT
- Reduced 0.09 lb daily CO2 per Capita with no Pavley adj. (22.53 lbs vs. 22.62 lbs 2035 baseline)
- Reduced 0.06 lb daily CO2 per Capita with Pavley adj. (14.56 lbs vs. 14.62 lbs 2035 baseline)

### Scenario B: TSI and Land Use Alternative

This scenario combines an expanded transit services and commuter friendly train service, plus analysis of a growth impact analysis example. The following summarizes the GHG reduction associated with this Scenario:

- Total daily vehicle trips=1.661 million, representing a reduction of 0.1% (or 2,234) daily vehicle trips
- Total daily VMT=11.435 million, representing a reduction of 0.06% or 7,184 daily VMT
- Reduced 0.01 lb daily CO2 per Capita with no Pavley adj. (22.52 lbs vs. 22.62 lbs for 2035 baseline)
- Reduced 0.07 lb daily CO2 per Capita with Pavley adj. (14.57 lbs vs. 14.62 lbs for 2035 baseline)
- Increased 1,956 transit (person) trips (31,077 vs. 29,121) when compared to 2035 baseline
- Increased 3,129 ridership (boardings) or 8.1% when compared to 2035 baseline
- Signal synchronization improvements would provide an additional 4,094 lb daily GHG reduction or 0.01 lb daily CO2 reduction per Capita (with no Pavley adj.)

Land Use – Employment Reduction/Densification Impacts: As part of 101-In-Motion, an alternative growth and land use scenario was tested to assess impacts on overall trips and corridor congestion. The scenario examined the impact of reducing the employment forecast and concentrating all new development on existing sites vs. vacant land. This resulted in a significant reduction in traffic growth on the west end of the South Coast Highway 101 corridor by approximately 2 - 4% and an improved freeway level of service, by at least one service level (LOS E/F to LOS D/E), by 2030 to 2035 timeframe. Both these improvements would lower GHG emissions; however, changes in models and a newer land use plan approved by the City of Goleta make a detailed assessment and comparison infeasible at this time.

### Scenario C: Pricing and Disincentives Alternative

This scenario assesses parking pricing policy options proposed in the draft City of Santa Barbara's General Plan, Plan Santa Barbara (PlanSB). The conceptual parking pricing provisions from PlanSB, though still under consideration by the City Council, were applied to the SBCAG model's 2035 forecast travel flows for downtown Santa Barbara area to estimate the GHG reduction benefits. (Technical details are provided in Appendix C):

- For the moderate parking policy provisions under PlanSB Alt. 1, approximately 97,700 VMT reductions would be expected in 2035, reflecting approximately 0.9% and 0.6% of GHG reduction per Capita without and with Pavley adjustments respectively.
- For the more aggressive parking policy provisions under Plan SB Alt. 2, approximately 172,000 VMT reductions would be expected in 2035, reflecting approximately 1.5% and 0.9% of GHG reduction per Capita without and with Pavley adjustments respectively.

**Table ES-2** portrays the aggregate emissions after incorporation of the three alternative planning scenarios.

**Table ES-2: Individual Planning Scenario Evaluation**

Planning Scenarios	Ranking	No Pavley/LCF Adj.	With Pavley LCF Adj.
		Daily GHG Emissions Per Capita	Daily GHG Emissions Per Capita
Alternative A: TDM & TSM	1st	22.53 lbs	14.56 lbs
Alternative B: TSI & Land Use	2nd	22.52 lbs	14.55 lbs
Alternative C: Pricing & Disincentives	3rd	22.30 lbs	14.40 lbs

**Cumulative GHG emissions reductions for all planning scenarios**

**Table ES-3** summarizes the GHG emission reductions for the 2035 horizon year for the alternative scenarios and discrete measures. The reference to "post processing" refers to the off-model techniques to estimate GHG reductions in areas where SBCAG model lacks capability or insensitive to a policy or factor. The adjustments are based on research inputs plus professional judgments to manually quantify the result. Those strategies that use post processing approach are documented in the Appendices.

As indicated in Table ES-3, total GHG emissions reduction by combining all strategies and options results in just 0.5 lbs per capita emission reduction by 2035 without Pavley adjustments. The total GHG emission per capita would be about 22.12 lbs (22.62 from 2035 baseline less 0.5 lbs cumulative emission reduction).

**Table ES-3: Summary GHG Emissions Reduction for 2035 Forecast and Alternative Planning Scenarios**

2035 Forecast and Alternative Planning Scenarios	Methodology	Vehicle Trips	VMT (Pass. Vehicles) 2/	Daily GHG Emissions Per Capita (lbs) (No Pavley Adj.)	Other Benefits
2005 Baseline (Modeled)	Model	1,331,802	10,798,463	22.24	
2035 Horizon Year (Modeled)	Model	1,663,729	12,978,262	22.62	
		Vehicle Trips Reduction	VMT Reduction (Pass. Vehicles) 2/	Daily GHG Reduction per Capita (No Pavley Adj.)	Other Benefits
<b>Scenario A: TDM / TSM</b>					
1. 101 In-Motion (TDM Package Option)	Model	5,955	128,700	0.07	
2. Commuter Challenges	Post Process	615	13,545	Inclusive	
3. Traffic Solutions Awareness Programs	Post Process	144	3,180	Inclusive	
4. Dynamic Ridesharing	Post Process	249	5,187	Inclusive	
5. Bottleneck Relief - Ramp Metering	Post Process	NA	NA	NA	Reduce delays, increase safety
6. Operational - Signal Synchronization	Post Process	NA	NA	0.01	Reduce a total daily GHG of 2 tons, reduce peak
<b>CUMULATIVE</b>		<b>6,963</b>	<b>150,612</b>	<b>0.08</b>	
<b>Scenario B: TSI and Land Use</b>					
1. Expand Transit System Services	Model	2,234	7,184	0.1	Increase 3,129 daily boardings
2. Expand Park-n-Ride Facilities	Post Process	551	26,737	Inclusive	
3. Expand Commuter-Friendly Train Rail Service	Model	Inclusive	Inclusive	Inclusive	
4. Land use (Employ't Reduction & Densification)	Post Process	NA	21,000	Inclusive	Reduced 2-7% vehicle trips on 101 during peak hour.
<b>CUMULATIVE</b>		<b>2,785</b>	<b>54,921</b>	<b>0.1</b>	
<b>Scenario C: Pricing and Disincentives</b>					
1. Parking Pricing Case Study 3/	Post Process	28,762	172,000	0.32	
<b>CUMULATIVE REDUCTION (A+B+C)</b>		<b>38,510</b>	<b>377,633</b>	<b>0.50</b>	

1/ Based on SBCAG Modeled output and include XX trips

2/ Based on a 50/50% Split (XX) approach and include 50% neighboring (XX) VMT.

3/ Based on PlanSB Alt 2.

### **Impact of State "Pavley/LCS" Controls on Vehicle Emissions**

Assuming implementation of the State "Pavley" in-vehicle emission controls and use of Low Carbon Fuel Standard (LCFS) gasoline these two measures alone apparently will enable the SBCAG region to generate in both 2020 and 2035 less passenger vehicle emissions that were generated in 1990 (4,730 tons per day). This analysis is based on travel activity data from the SBCAG model run through the air quality emissions model, EMFAC, and the Pavley Post Processor distributed by ARB. These emission reductions dwarf savings from selected TDM, TSM, and other measures. While this analysis inherently assumes our existing vehicle fleet "turns over" to a newer, cleaner fleet, which may be optimistic given existing economic conditions, it does bode well for ongoing reductions in the contributions of passenger vehicles to CO<sub>2</sub> emissions.

### **Findings and Conclusions**

- Preliminary analyses of the alternative planning scenarios indicates that the potential of these measures on GHG reduction is relatively small (less than 1% of VMT and GHG reduction) for the 2035 horizon year, and even less for the 2020 interim year, if the Pavley/LCF adjustments were not taken into consideration.
- Pavley and LCF adjustments will offer significant reductions to GHG production in future years.
- The parking pricing example has indicated significant potential in achieving GHG reduction benefits. However, since only three institutions in Santa Barbara County (the City of Santa Barbara, Santa Barbara City College, and UCSB) charge for parking, this alternative has limited applicability at this time for Santa Barbara County.
- The TDM alternative remains the best approach to reduce GHG emissions in the future since small changes in individual behavior can result in cumulative reductions in single occupant vehicle trips and vehicle miles traveled.
- At this time for the SBCAG region, technology advances and improvements in vehicle performance and fuel efficiency coupled with TDM strategies remain the best approach to reduce future GHG emissions.
- While transit system improvements examined alone appear to have limited GHG reduction benefits, the analysis by other MPOs indicate the combination of supportive land uses and fare policy options can achieve beneficial results. The effect of changes in land use on future emissions is yet to be determined and will be assessed during the development of the Sustainable Communities Strategy as part of SBCAG's response to SB-375.

# **I. Introduction**

## **Background**

At the request of Air Resources Board and as outlined in the report by the Regional Targets Advisory Committee (RTAC), the 18 Metropolitan Planning Organizations (MPOs) in California agreed to conduct analyses of the Green House Gas (GHG) emissions reduction benefits of various alternative planning scenarios. The purpose of this analysis is to assist Air Resources Board (ARB) in setting GHG emission reduction targets by June 2010 as part of the SB-375 implementation.

This draft document outlines the assumptions and technical analyses of these planning scenarios that estimate the GHG emission reductions for the future 2020 interim and 2035 horizon years. This report contains three major elements:

- Newly updated SBCAG travel forecasts for the 2005 Base Year, 2020 and 2035 for Santa Barbara County
- The assumptions and analyses of three alternative planning scenarios
- The preliminary findings of GHG emission reductions for submittal to ARB.

Because of the complexity of the planning process, representatives of all 18 MPOs in California have been meeting continuously for the last several months to hammer out a consistent approach to deal with the technical challenges and consistent reporting of the scenarios for submittal to ARB. This draft report follows the general guidelines and agreements of the MPO Planning Work Group.

This analysis was conducted under guidelines established by ARB and the largest MPOs in the state. These guidelines placed five general conditions on the analysis:

1. 50% of all trips that travel between MPO boundaries, in our case SBCAG and SLOCOG in the north, and SBCAG and SCAG in the south will be addressed by each MPO;
2. The analysis will separate out the benefits of state in-vehicle emission controls that will phase in over-time with vehicle fleet turnover (i.e., the Pavley / Low Carbon Fuel Standard (LCF) adjustments);
3. The composition of the scenarios and their constituent measures are standardized;
4. The assessments will be based on existing modeling capabilities from existing data; and
5. Consistent base and forecast years and metrics in data reporting will be used.

Because the adopted SBCAG 2009 Regional Transportation Plan (2009RTP) contains a 2000 base year with a 2030 travel forecast based on the previous 2002 Regional Growth Forecast (02'RGF), an update to the 2009 RTP travel forecast using the latest adopted 2007 RGF is necessary. Recently SBCAG completed an update of the following travel forecasts:

- 2005 Base Year
- 2020 Interim Year
- 2035 Horizon Year

## **Alternative Planning Scenarios**

In addition to updating the forecast to 2005, 2020, and 2035, staff also tested three alternative planning scenarios to examine the potential to reduce future GHG emissions. Each of these scenarios further expands and enhances the implementation of various strategies and policies over-and-above the currently adopted 2009 RTP. For each scenario is a bundle of similar strategies and programs to reduce emissions has been tested, with the goal of producing the best possible "ambitious and achievable" composite results under the RTAC guidelines. A combination of analytical methodologies and techniques were employed. This includes the use of the SBCAG travel model, a combination of modeling and "post processing" or "off-model" techniques, incorporation of a previous land use sensitivity study in the 101 In-



Motion report, and, a parking pricing example from City of Santa Barbara's ongoing Plan Santa Barbara. The three alternative planning scenario bundles are summarized in **Table I-1**. They are:

Scenario A: Transportation Demand Management (TDM) and Transportation System Management (TSM) Alternative

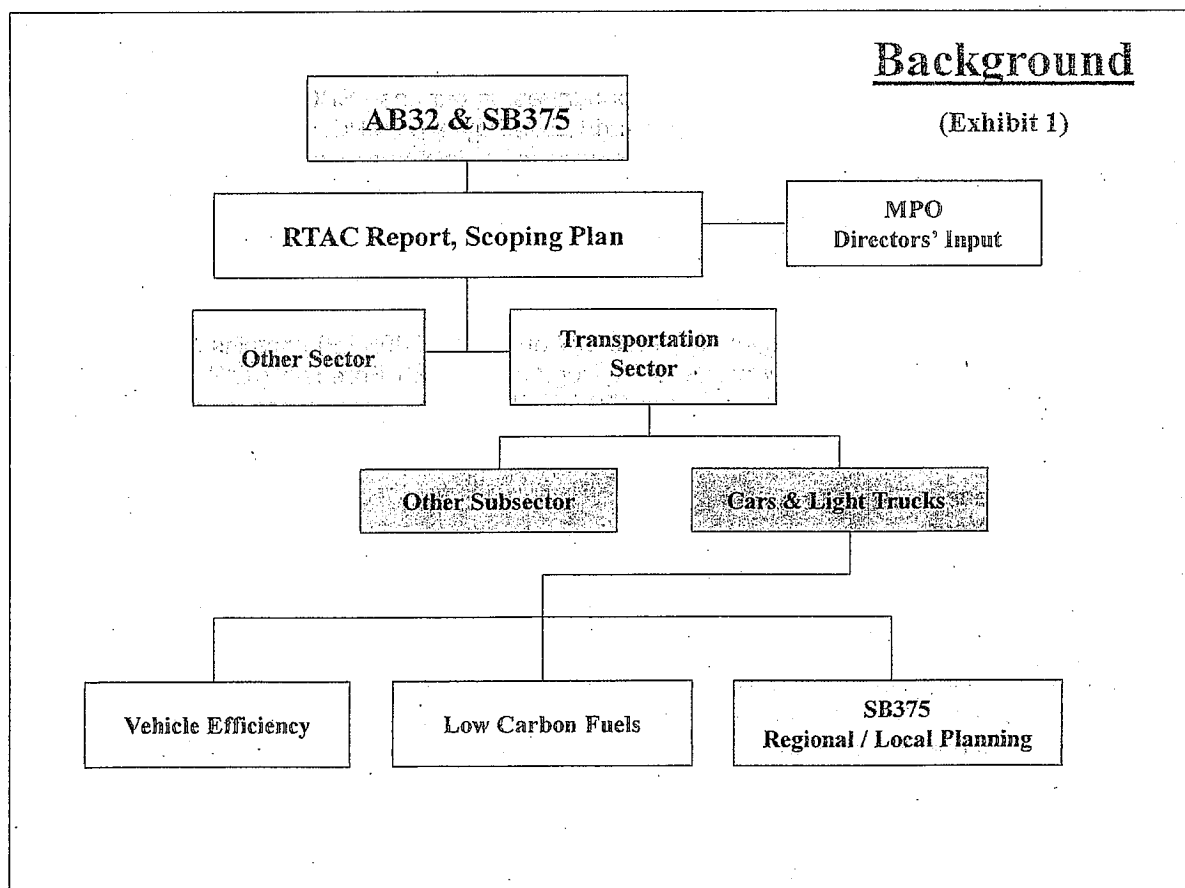
Scenario B: Transportation System Improvements (TSI) and Land Use Alternative

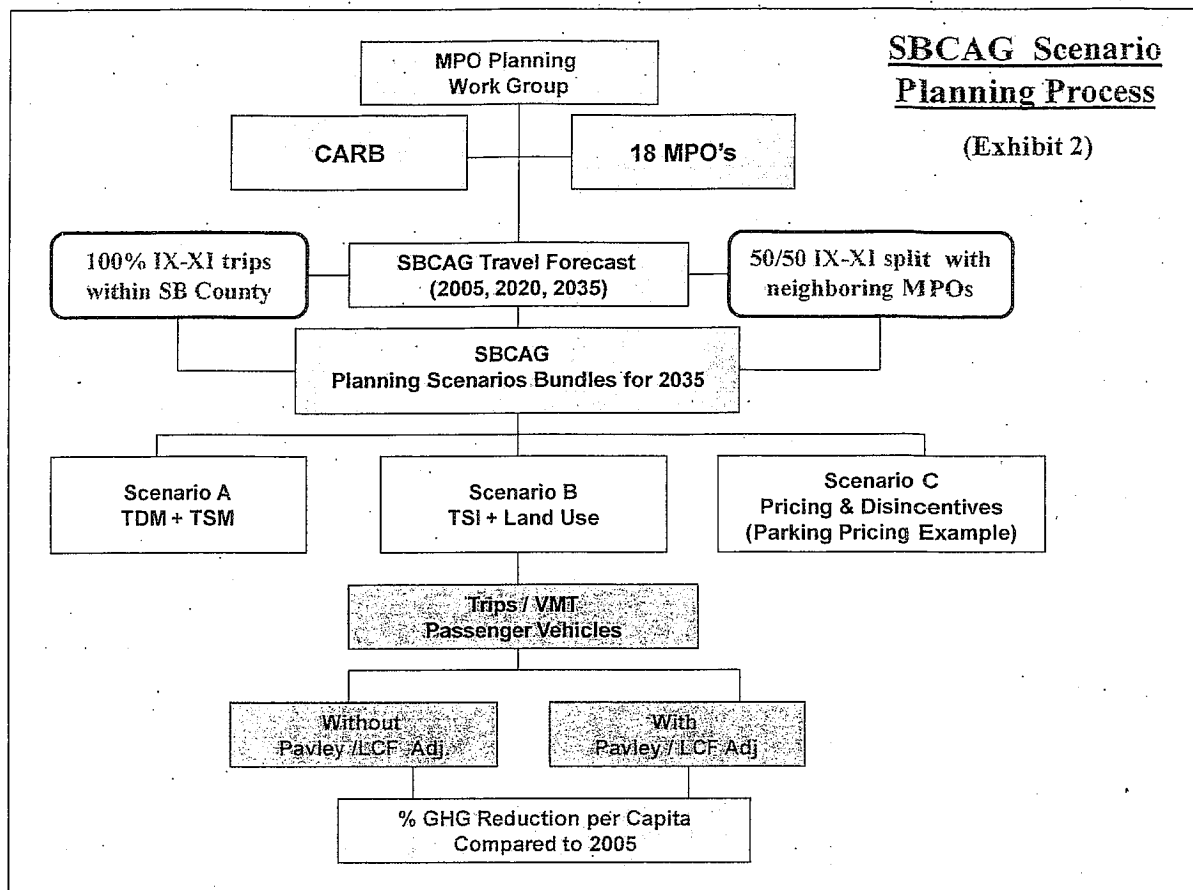
Scenario C: Pricing and Disincentives Alternative

These scenarios are described in detail in Section IV of this report.

As shown below in **Exhibit 1** this analysis stems from the requirements imposed by SB-375. The Regional Targets Advisory Committee, created by Air Resources Board, outlined a general method to assess the benefits of emission reduction strategies. These strategies address emissions from the transportation sector, specifically cars and light trucks. Low carbon fuels and in-vehicle emission controls are important components in achieving emission reductions but demand management, transit availability, and land use decisions also play a role and SB-375 requires that more emphasis be placed by MPOs on these programs that integrate land use and transportation.

**Exhibit 2** summarizes the focus of the technical analysis. The 18 MPOs use their travel forecasts as a baseline estimate of future growth in person trips, vehicle trips, and total vehicle miles traveled out to the years 2020 and 2035. Agreements between MPOs address the trips that travel between MPO boundaries. Next, alternative packages are developed to assess the impacts of various control strategies on these measures, with and without state mandated in-vehicle or fuel controls.





**Table I-1: Description of SBCAG Alternative Planning Scenarios for SB375 GHG Emissions Reduction Target Setting**

Scenario Categories		Methodology	Level of Deployment	2009 RTP Baseline	Scenario A: TDM & TSM Alternative	Scenario B: TSI & Land Use Alternative	Scenario C: Pricing & Disincentives
Transportation Demand Management (TDM) and Transportation System Management (TSM)							
1	Rideshare, Individual Marketing, Flex Work (Telecommute, Vanpool)	Modify 101 IM Package Option in Model - Base trip reduction - 1085 trips reduction for each AM & PM period. Run model	Assumed an increase of 100% trip reduction as "ambitious but achievable" approach (from 1085 to 2170 trips for each peak period) for 2020 and 2035	1085 trips reduced for each AM and PM peak hour	Test		
2	Traffic Solutions: Commuter Challenge	Review and post process new/ongoing Commuter Challenge Programs for GHG benefits.	Assess all modes of transportation including bike trips as part of larger promotions such as "CycleMaynia" or bike month.	No	Test		
3	Traffic Solutions: Awareness Programs	Review and post process new/ongoing TS Awareness Programs for GHG benefits.	Assess effectiveness of dissemination of promotional information to the general public and employers throughout Santa Barbara County at address vehicle trip reduction.	No	Test		
4	Traffic Solutions: Dynamic Ridesharing	Review and post process new Dynamic Ridesharing Programs for GHG benefits.	Employ smart phone technology to enable real time instant carpool matching	No	Test		
5	Parking Pricing	Use CSMP results for 101 mainline to formulate approach. Post process	CSMP assumed a system-wide ramp metering in place on South Coast 101 where the right conditions exist. Queue spill-back detectors are assumed in operations in test sites.	No	Test		
6	Operational strategies: ITS, Signal Synchronization	Assumed signal synchronization in place to estimate GHG reduction benefits via 2035 travel flows and improved average speeds. Post process	Assumed two potential arterial corridors on the South Coast for signal synchronization to estimate GHG reduction benefits. Post process	No	Test		
Transportation System Improvements and Land Use							
1	Expand transit system, transit station P&R Facilities	Double existing transit frequency and run model based on 2007 trunk and express. Post process expanded PnR facilities	Based on with 2007 transit system (2009RTP), assumed new PnR facilities and project vehicle reduction using counts, field surveys.	Limited		Test	
2	Commuter Friendly Train Rail Service Expansion	Modify 101 IM "Commuter Rail" to "Expand Commuter Friendly Rail Service" both in each AM and PM periods, using the latest CSMP analysis on Commuter Friendly Rail Service improvements assumptions	CSMP assumed a lower vehicle trips reduction than the 101 IM Study (from 385-285 trips reduction). By 2035, the original 101IM vehicle trip reduction is assumed based on new state supported trains.	385 trips reduced for each AM and PM period.			
3	SubArea Redevelopment Pattern	Test lower employment growth rate and re-development pattern in the Goleta Area	Assumed higher household population and no vacant land devoted to housing and employment with job increases due to density at job sites, resulting in 75% less in employment	No		Test	
Pricing and Disincentives						Example	
1	Parking Pricing	Assess Parking Pricing Policy Options proposed in the Draft City of Santa Barbara (PlanSB), Post Process	Limit to draft City of Santa Barbara's (PlanSB) proposal	No			Example

## II. Regional Growth Forecast (RGF) 2007

The current 2009 Regional Transportation Plan (RTP) is based on the 2002 Regional Growth Forecast (02'RGF). The SBCAG Travel model database was updated most recently using the latest adopted 2007 RGF. **Table II-1** provides a comparative summary of the socioeconomic database (population, household and employment) between the 02'RGF and the new 07'RGF.

In general, the new RGF forecasts a lower long-term growth rate in population, household and employment for Santa Barbara County, reflecting the slower future economic growth. Population growth is 8.2 percent less when compared with the 02'RGF (from 521,000 to 481,400 by 2030). Similarly, employment is 10.3 percent less by 2030 (from 257,000 to 233,000). Household growth, however, reduces slightly, by approximately 1.5 percent, from 166,671 to 164,400, for the same period. More detailed information regarding the growth forecast is available from the adopted 2007 Regional Growth Forecast. The document is readily available on the SBCAG website, [www.sbcag.org](http://www.sbcag.org). One caution is this forecast preceded the 2008-09 nationwide recession and so these forecasts may be optimistic in the short term.

The population projection from the California Department of Finance (DOF) has been consistently higher than the MPOs' forecasts in California, averaging about 3-5 percent. Under a "per capita" basis, this percent difference will have an impact on MPO's GHG emissions calculations. This has been one of the ongoing issues to be resolved by the MPO Planning Work Group. The population information presented in Table II-1 is based on the adopted 07'RGF for calculation of GHG emissions reductions for the SBCAG region on a "per capita" basis, the SBCAG population projections from the 2007 RGF are used.

**Table II-1: Growth Forecast for the SBCAG Travel Demand Model**

SBCAG Model Database	2000/2005			2020			2030			2035			2040		
	Pop'n	Households	Employ't	Pop'n	Households	Employ't	Pop'n	Households	Employ't	Pop'n	Households	Employ't	Pop'n	Households	Employ't
2000 (02'RGF)	399,000	136,622	178,000	505,000	164,641	231,000	521,000	166,671	257,000	NA	NA	NA	NA	NA	NA
New Forecast (07'RGF) (2005 Base Yr) 1/	417,500	143,138	188,051	459,600	157,648	216,001	481,400	164,422	233,001	487,000	165,970	241,001	492,800	167,542	249,001
DOF Pop Forecasts 3/	400,778	--	--	464,019	--	--	484,000	--	--	497,600	--	--	NA	--	--

1/ Revised DOF forecast, 2007RGF, App. 9, Pg. 10

2/ Current SBCAG Model, 040308

3/ Department of Finance forecasts based on information from 2007 RGF. DOF population for 2035 is provided from the MPO Planning Work Group.

### III. New Travel Forecast

#### Time Horizon

This report contains the following travel forecasts based on the updated socioeconomic data in the 2007 Regional Growth Forecast. The forecast years of 2020 and 2035 are specified in SB-375 and represent GHG emission reduction target years. The year 2005 was selected by the MPO's as the base year for comparison purposes:

- 2005 Base Year
- 2020 Interim Year - 2020 Program Forecast
- 2035 Horizon Year - 2035 Plan Forecast

The 2005 Base Year forecast updates the 2000 Base Year forecast in the currently adopted 2009 RTP. The 2020 Program forecast contains capital improvement projects from the 2009 RTP that were programmed and funded through to the year 2020. The 2035 Plan forecast includes all programmed and planned capital improvement projects through to the year 2035. The 2035 forecast includes the 101 High Occupancy Vehicle (HOV) lane widening between the Santa Barbara County line and the Hot Springs/Cabrillo Interchange.

The summary table below compares the travel forecast for 2002 and 2007.

**Table III-1 Model Output Comparison, 2005, 2020, and 2035**

	2009 RTP 1/		New Forecast 2/		
	2000BC	2030 Plnd	2005	2020Prog	2035Plnd
<b>Population</b>	399,343	523,529	417,500	459,600	487,000
<b>Household</b>	136,620	167,031	143,138	157,648	165,970
<b>Employment</b>	200,332	278,522	188,051	216,001	241,001
<b>Total Person Trips</b>	1,900,788	2,569,152	1,996,029	2,360,111	2,515,428
<b>Total Veh Trips</b>	1,271,900	1,703,400	1,331,802	1,560,118	1,663,729
<b>Total VMT</b>	9,423,000	14,862,700	9,605,095	10,934,981	11,442,169
<b>TOTAL VHT</b>	207,473	329,758	217,955	259,660	257,583

1/ Based on 2002 RGF.

2/ Based on 2007 RGF.

#### Metrics for Measuring Greenhouse Gas Reductions

According to the ongoing discussions from the MPO Planning Work Group, there is a general agreement in using the following metrics, described below, to report on the analysis of alternative planning scenarios:

- Vehicle Trips (VT) and Vehicle Miles Traveled (VMT) for Passenger Vehicles
- Daily (GHG) CO<sub>2</sub> Emissions per Capita (lbs) without Pavley/LCF Adjustments
- Daily (GHG) CO<sub>2</sub> Emissions per Capita (lbs) with Pavley/LCF Adjustments
- Daily (GHG) CO<sub>2</sub> % Reduction per Capita without Pavley/LCF Adjustments
- Daily (GHG) CO<sub>2</sub> % Reduction per Capita with Pavley/LCF Adjustments

Vehicle Trips (VT) and Vehicle Miles Traveled (VMT) for Passenger Vehicles: According to the ARB Emission Factors Model (EMFAC) output, vehicles are classified into various vehicle types, from passenger autos to various types of heavy duty trucks. For target setting, ARB requires only the model output from "passenger vehicles", which includes Light Duty Autos (LDA), Light Duty Trucks 1 and 2 (LDT1, LDT2), and Medium Duty Trucks (MDT). The VMT, which refers the total daily vehicle miles traveled, is the product of

total daily vehicle trips and the distance of the roadway network (link) the vehicle travels. In the SBCAG model, the output of total vehicle trips from the model includes all vehicles. This output serves as input into ARB's EMFAC model and is further disaggregated into various vehicle types. The VT and VMT for passenger vehicles refer to the sums of VT and VMT resulting from the above four passenger vehicle types, i.e., LDA, LDT1, LDT2, and MDT. Therefore, the results in this draft report only include passenger vehicles.

Daily CO<sub>2</sub> Emissions per Capita without Pavley/LCF Adjustments: This metric identifies the amount of CO<sub>2</sub> emitted per capita assuming the Pavley/LCF (Low Carbon Fuel Standard) controls is not yet in place. The VMT and trips developed from the SBCAG model are inputs into EMFAC to determine the CO<sub>2</sub> emissions. The EMFAC CO<sub>2</sub> results will then be divided by the 2007RGF population estimates to determine the "CO<sub>2</sub> per Capita without Pavley/LCF controls for each of the scenarios.

Daily CO<sub>2</sub> Emissions per Capita with Pavley/LCF Adjustments: This metric identifies the amount of CO<sub>2</sub> emitted per person assuming the Pavley/LCF controls are in place. The VMT and trips developed from the SBCAG model will be input into EMFAC to determine the CO<sub>2</sub> emissions. The EMFAC results are input into the ARB's Pavley/LCF Post-Processor to determine the total emissions. These emissions are divided by the 2007RGF population estimates to determine the "CO<sub>2</sub> per Capita with Pavley/LCF Adjustments" for each scenario. More information on the post-processing is provided Appendix B.

Daily GHG (CO<sub>2</sub>) % Reduction without Pavley/LCF Adjustments: This metric is a comparison of the Scenarios by CO<sub>2</sub> emissions versus the 2005 Base Year without the Pavley/LCF Adjustments. Similar to the above method, the trip and VMT forecasts from the SBCAG model for the scenario will be calculated in EMFAC. The CO<sub>2</sub> emissions for the scenario are subtracted from the 2005 baseline CO<sub>2</sub> emissions (without the Pavley/LCFS adjustments) to determine the total percentage reduction, if applicable.

Daily GHG (CO<sub>2</sub>) % Reduction with Pavley/LCF Adjustments: This metric is a comparison of the Scenarios by CO<sub>2</sub> emissions to the 2005 Base Year with the Pavley/LCF Adjustments. Similar to the above method, the trips and VMT forecasts from the SBCAG model for the scenario will be calculated in EMFAC and then run through the ARB Pavley/LCF Post-Processor. The CO<sub>2</sub> emissions for the scenario will be divided from the 2005 baseline CO<sub>2</sub> emissions (assuming the Pavley/LCF adjustments) to determine the total percentage reduction. (Note that GHG can be substituted by CO<sub>2</sub> since EMFAC only calculates CO<sub>2</sub>).

It should be noted that due to the tight time frame for this preliminary analysis to be submitted to ARB and the degree of complexity of the calculations, a simplified method of converting "modeled trips and VMT" to "passenger vehicle trips and VMT" was employed. Historically, the four classes of "passenger vehicles VMT" as calculated from EMFAC is 93.3 percent of the total "modeled VMT". This relationship was used to calculate to estimate the new passenger vehicle trips and VMT as required by ARB.

#### **Definition of Inter-Regional Travel under SB375 and its Impacts on Santa Barbara County**

The RTAC Report includes a generic definition of "inter-regional travel" for use in target setting calculation. It also contains a general guidance on treatment of GHG from inter-regional travel flows. In the context of this report, the "inter-regional travel" refers to the "Internal-External and External-Internal" or IX-XI travel flows (vehicle trips). The general guidance is that GHG emissions from inter-regional passenger vehicle flows should be "shared equally" between the MPOs which generate the travel flow, i.e., the MPOs in which the origins or destinations of the flows are located.

Geographically, San Luis Obispo County is located to the north of Santa Barbara County. Ventura County is located to the south. Trips originated from San Luis Obispo County and points north into Santa Barbara County and from Ventura County and points south, and vice versa, are considered IX-XI trips. Trips traveling within the MPO's boundary are referred as "internal - Internal" or I-I trips. Trips that pass through the MPO's boundary (Santa Barbara County in this case) are referred as "through trips" or X-X trips. The following are the general guidance from the RTAC Report:

- Each MPO estimates the IX-XI GHG for their flow to the other MPO boundary and counts 50 percent of their own flow and 50 percent of the other MPO's flow. The rationale is to estimate GHG emissions based on an equal "50/50" split between neighboring MPO boundaries.

- Through trips or X-X trips are to be "deducted" (discarded) from the MPO's flow for SB375 GHG emissions calculations.
- MPOs are required to closely coordinate with their neighboring MPOs for calculation of IX-XI flows and GHG emissions reduction.

Due to the high cost of housing in south Santa Barbara County, this region experiences a significant number of commuters from Ventura County, which is within the SCAG region. Also, this region is home to a robust tourism economy and is a major destination for travelers. At the same time, most residents living in south Santa Barbara County work in south Santa Barbara County and do not travel outside of the County. On the other hand, there are a significant number of daily commuters (15,000 to 18,000) who live in Ventura and travel to South Santa Barbara County to work. With the number of employees who reside outside the county plus the tourist trips into the County from Ventura and points south, there is a significant imbalance of IX-XI trips. In order to account for this phenomenon, the VMT estimates need to include miles traveled through those areas to south of the Santa Barbara County. For example, a Ventura County resident might travel from Oxnard or Simi Valley to downtown Santa Barbara to work; alternatively a tourist may travel from Los Angeles to Santa Barbara to visit. The same also holds true for 50 percent of XI trips between SLO County and Santa Barbara County. In addition, both the RTAC and the MPO Planning Work Group therefore strongly recommended close coordination and collaboration among MPOs.

The Southern California Association of Governments (SCAG) is the MPO for Ventura County. The external flows coming from Ventura County and points south, i.e., from the SCAG Model, would incur a much large proportion of "External-Internal" or "XI" trips and subsequently higher VMT since the average trip distance from the Ventura and points south to the southern border of Santa Barbara County is much longer (averaging approximately 40 miles as estimated from SCAG) as opposed to "Internal-External" (IX) trips from Santa Barbara County going south (about 10.2 miles under the 2000 Base Case).

Since the MPO Planning Work Group decided to use a uniform 50/50 split of external travel method to calculate VMT for all MPOs for the target setting analysis, staff has worked closely with SLOCOG and SCAG in the exchange of modeled output, particularly for the exchange of the IX-XI trip forecasts, in order to estimate passenger vehicle trips and VMT.

The following two charts demonstrated the impacts of calculating VMT and GHG Emissions per Capita in 2035 (with no Pavley /LCF adj.) for Santa Barbara County based on the two approaches, i.e., the "50/50 split IX-XI" trip approach between neighboring MPOs and the "100% IX-XI" trips within Santa Barbara County approach. **Table III-1** presents the calculations and the likely impacts of external travel calculated by the two approaches by vehicle trip types, i.e., I-I, IX-XI, and XX trips.

Using the assumption of 50 percent XI trips (and consequently VMT) incurs a much more significant VMT impact on SBCAG's GHG emissions calculations than using the 100 percent IX-XI flows computed within the Santa Barbara County. The "50/50 split" approach results in a 20-30% higher daily VMT, and consequently GHG emissions (without Pavley/LCF adj.) than the daily VMT calculated within Santa Barbara County simply because of the longer traveling distances for these IX-XI trips.

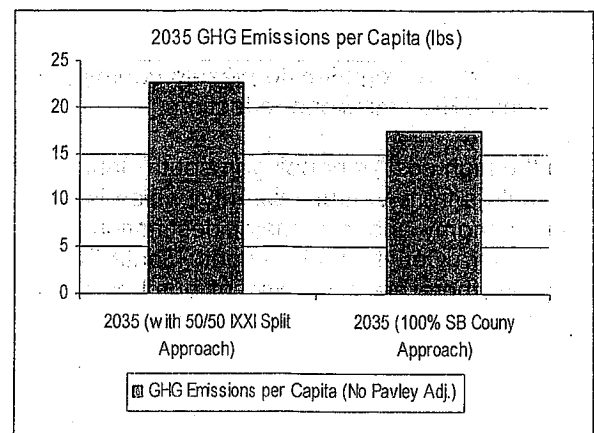
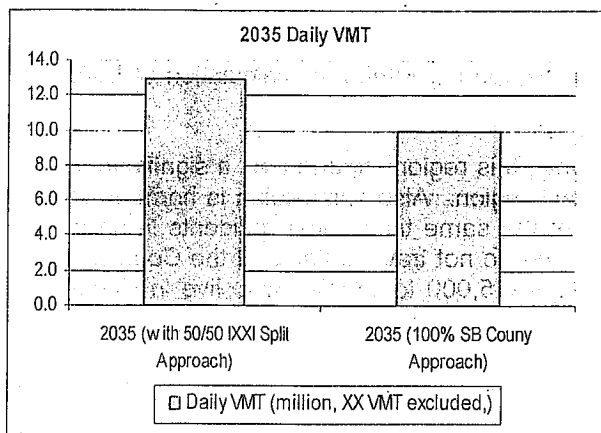




Table: III-1 Impacts of External Travel for Santa Barbara County

2000 Base Year (2009 RTP)				(100% I-I, 50% IX-XI, 0% X-X)			(100% I-I, 100% IX-XI, 0% X-X)		
SBCAG Model Domain	Total VMT (Pax Veh.) for SBCAG			Total VMT (Pax Veh.) for SBCAG					
	I-I	IX-XI @50%	X-X	I-I	IX-XI @100%	X-X			
SBCAG 1/	7,893,682	654,633	45,592	7,893,682	1,309,266	45,592			
SCAG (Ventura Co. & Pts south) 2/		1,185,600	(Discarded)		NA	(Discarded)			
SLOCOG (SLO Co. & pts north) 3/		450,000			NA				
SubTotal	7,893,682	2,290,233	0	7,893,682	1,309,266	0			
TOTAL VMT (Pax Vehicles)			10,183,915			9,202,948			

2005 New Base Year		(100% I-I, 50% IX-XI, 0% X-X)			(100% I-I, 100% IX-XI, 0% X-X)		
SBCAG Model Domain	Total VMT (Pax Veh) for SBCAG			Total VMT (Pax Veh) for SBCAG			
	I-I	IX-XI @50%	X-X	I-I	IX-XI @100%	X-X	
SBCAG 1/	6,986,773	587,223	152,002	6,986,773	1,174,445	152,002	
SCAG (Ventura Co. & Pts south) 2/		2,535,000	(Discarded)		NA	(Discarded)	
SLOCOG (SLO Co. & pts north) 3/		689,468			NA		
SubTotal	6,986,773	3,811,691	0	6,986,773	1,174,445	0	
TOTAL VMT (Pax Vehicles)			10,798,463			8,161,218	

2020	(100% I-I, 50% IX-XI, 0% X-X)			(100% I-I, 100% IX-XI, 0% X-X)		
SBCAG Model Domain	Total VMT (Pax Veh) for SBCAG			Total VMT (Pax Veh) for SBCAG		
	I-I	IX-XI @50%	X-X	I-I	IX-XI @100%	X-X
SBCAG 1/	8,086,605	776,198	187,185	8,086,605	1,552,396	187,185
SCAG (Ventura Co. & Pts south) 2/		3,000,000	(Discarded)		NA	(Discarded)
SLOCOG (SLO Co. & pts north) 3/		745,476			NA	
SubTotal	8,086,605	4,521,674	0	8,086,605	1,552,396	0
TOTAL VMT (Pax Vehicles)			12,608,278			9,639,000

2035		(100% I-I, 50% IX-XI, 0% X-X)			(100% I-I, 100% IX-XI, 0% X-X)		
SBCAG Model Domain	Total VMT (Pax Veh) for SBCAG			Total VMT (Pax Veh) for SBCAG			
	I-I	IX-XI @50%	X-X	I-I	IX-XI @100%	X-X	
SBCAG 1/	8,213,688	913,090	230,627	8,213,688	1,826,179	230,627	
SCAG (Ventura Co. & Pts south) 2/		3,050,000	(Discarded)		NA	(Discarded)	
SLOCOG (SLO Co. & pts north) 3/		801,485			NA		
SubTotal	8,213,688	4,764,575	0	8,213,688	1,826,179	0	
TOTAL VMT (Pax Vehicles)			12,978,262			10,039,867	

1/ Total VMT from SBCAG Model.

2/ Total VMT from SCAG Model for Ventura County and points south.

3/ Total VMT from SLOCOG for SLO County and points north.

4/ SLO 2020 VMT for IX was interpolated due to data unavailability from SLOCOG.

## SBCAG Travel Forecast and GHG Emissions

Table III-2 summarizes the GHG emissions reduction results for the 2005 Base Year, 2020 interim, and 2035 horizon years. The forecasts are presented under two scenarios: The 50/50 split of IXXI VMT between neighboring MPOs (SLO and Ventura Counties) and the 100 percent VMT all within Santa Barbara County. For the 2005 calculations, no ARB Pavley/LCF adjustments were used as the technology was not available in 2005. As indicated earlier, in general the total VMT resulted from the 50/50 split of IXXI trips computing approach is higher than the 100 percent IXXI trips assumption.

Under the 50/50 split IXXI approach, total VMT for Santa Barbara County is projected to be 10.80 million for 2005, 12.61 million for 2020, and 12.98 million for 2035. Approximately 22.2 percent emissions reduction is expected for 2020 and 34.3 percent emissions reduction is expected for 2035 with the Pavley/LCF adjustments. Under the 100 percent IXXI approach, total VMT for Santa Barbara County is projected to be lower, 8.16 million for 2005, 9.64 million for 2020, and 10.04 million for 2035. Using the 2007 RGF population projection and with the Pavley/LCFS adjustment, the results are as follows:

### Without Pavley/LCF Adjustments:

- 2005: Daily CO2 per Capita (lbs) = 16.8, (17.1 is XX VMT is included)
- 2020: Daily CO2 per Capita (lbs) = 17.8 (18.2 is XX VMT is included)
- 2035: Daily CO2 per Capita (lbs) = 17.5 (17.9 is XX VMT is included)
- % CO2 Increase vs. 2005BC: 2020 = 6.0% increase; 2035 = 4.1% increase

### With Pavley/LCF Adjustments:

- 2005: Daily CO2 per Capita (lbs) = 16.8 (17.1 is XX VMT is included)
- 2020: Daily CO2 per Capita (lbs) = 13.2 (13.5 is XX VMT is included)
- 2035: Daily CO2 per Capita (lbs) = 11.3 (11.6 is XX VMT is included)
- % CO2 Reduction compared to 2005BC: 2020 = 21.3% reduction; 2035 = 32.7% reduction

Table III-2: Summary of GHG Emissions for 2005 base Year, 2020, and 2035

Based on 50/50 split of IX-XI VMT betw neighboring MPOs

SBCAG VMT & GHG Emissions	SBCAG Base Yr Scenario		SBCAG Forecast	
	2000	2005	2020	2035
VMT for Pax Veh (LDA, LDH, LDT2, MDV)				
Internal I-I	7,893,682	6,986,773	8,086,605	8,213,688
Interregional IX - XI 1/	2,290,233	3,811,691	4,521,674	4,764,575
Through X - X (Discarded)	45,592	152,002	187,185	230,627
TOTAL I-I & IX-XI VMT	10,183,915	10,790,464	12,609,279	12,978,263
Population: SBCAG 07RGF	399,300	417,500	459,600	487,600
Weekday CO2 (Tons) Ton = 2000 lbs				
Internal I-I	3,354.81	3,004.31	3,436.81	3,490.82
Interregional IX - XI	973.35	1,639.03	1,921.71	2,024.94
Through X - X (Discarded)	19.38	65.36	79.55	98.02
TOTAL (I-I + IX - XI), No Pavley/LCFS Adj. (Tons)	4,328.16	4,643.34	5,358.52	5,515.76
Pavley & LCFS adjustment factor	0	0	0.742	0.646
TOTAL with Pavley/LCFS Adj. (Tons)	4,328.16	4,643.34	3,976.02	3,563.18
Internal I-I	16.80	14.39	14.96	14.32
Interregional XI - IX	4.88	7.85	8.36	8.31
Through X - X (Discarded)	0.10	0.31	0.35	0.40
Daily CO2 per Capita (lbs) - No Pavley/LCFS Adj. (lbs)	21.68	22.24	23.32	22.62
% CO2 Reduction (No Pavley + LCFS) Compared to 2005BC			4.8%	1.7%
Internal I-I	16.80	14.39	11.10	9.25
Interregional XI - IX	4.88	7.85	6.21	5.37
Through X - X (Discarded)	0.10	0.31	0.26	0.26
Daily CO2 per Capita - With Pavley/LCFS Adj. (lbs)	21.68	22.24	17.30	14.62
% CO2 Reduction (with Pavley + LCFS) Compared to 2005BC			-22.2%	-34.3%

1/ IX-XI VMT will change when final values obtained from SCAG.

Based on 100% of IX-XI VMT within Santa Barbara County

SBCAG VMT & GHG Emissions	SBCAG Base Yr Scenario		SBCAG Forecast	
	2000	2005	2020	2035
VMT for Pax Veh (LDA, LDH, LDT2, MDV)				
Internal I-I	7,893,682	6,986,773	8,086,605	8,213,688
Interregional IX - XI 1/	1,309,266	1,174,445	1,552,396	1,826,179
Through X - X (Discarded)	45,592	152,002	187,185	230,627
TOTAL I-I & IX-XI VMT	9,202,948	8,161,218	9,639,001	10,039,867
Population: SBCAG 07RGF	399,300	417,500	459,600	487,600
Weekday CO2 (Tons) Ton = 2000 lbs				
Internal I-I	3,354.81	3,004.31	3,436.81	3,490.82
Interregional IX - XI	556.44	505.01	659.77	776.13
Through X - X (Discarded)	19.38	65.36	79.55	98.02
TOTAL (I-I + IX - XI), No Pavley/LCFS Adj. (Tons)	3,911.25	3,509.32	4,096.58	4,266.94
Pavley & LCFS adjustment factor	0	0	0.742	0.646
TOTAL with Pavley/LCFS Adj. (Tons)	3,911.25	3,509.32	3,039.66	2,756.45
Internal I-I	16.80	14.39	14.96	14.32
Interregional XI - IX	2.79	2.42	2.87	3.18
Through X - X (Discarded)	0.10	0.31	0.35	0.40
Daily CO2 per Capita (lbs) - No Pavley/LCFS Adj. (lbs)	19.59	16.81	17.83	17.50
% CO2 Reduction (No Pavley + LCFS) Compared to 2005BC			6.0%	4.1%
Internal I-I	16.80	14.39	11.10	9.25
Interregional XI - IX	2.79	2.42	2.13	2.06
Through X - X (Discarded)	0.10	0.31	0.26	0.26
Daily CO2 per Capita - With Pavley/LCFS Adj. (lbs)	19.59	16.81	13.23	11.31
% CO2 Reduction (With Pavley + LCFS) Compared to 2005BC			-21.3%	-32.7%

1/ IX-XI VMT will change when final values obtained from SCAG.

## IV. Alternative Planning Scenarios Tested for GHG Target Setting

This section describes the SBCAG alternative planning scenarios. Three scenarios assess strategies and policy options to provide the best possible GHG emissions reduction potential under the RTAC's recommended "ambitious and achievable" approach for the 2035 horizon year. As recommended by RTAC and the MPO Planning Work Group, only the "50/50 split of IX-XI approach" is evaluated to estimate VMT and GHG reductions.

### **SCENARIO A: Transportation Demand Management and Transportation System Management**

Scenario A combines the TDM and TSM strategies. Estimation of GHG reduction employs a combination of the SBCAG model and a "post processing" technique (off-model procedure) to compute, to the extent possible, the GHG reduction benefits for the 2035 horizon year. The 2020 results are to be interpolated between 2005 and 2035 GHG reduction estimates.

Transportation Demand Management (TDM) refers to the implementation of measures which encourage people to change their mode of travel, or not to make a trip at all, e.g., ridesharing, pricing incentives, parking management and telecommuting.

Transportation System Management (TSM) refers to relatively low-cost improvements designed to make the transportation system work more efficiently and to increase its people carrying capacity.

#### **101 In-Motion Strategies**

The current SBCAG model already incorporated the TDM modeling capability from the 101 In-Motion Corridor Study. This is a "turn-on or -off capability" in the model. The TDM measures incorporated in the model include rideshare, individual marketing, and flexible work which assumed a reduction of approximately 1,085 vehicle trips during each AM and PM peak hour as analyzed in the 101 IM Study. Under Scenario A, the following new assumptions were employed:

- Expand 101 IM Study TDM Trip Reduction – In addition to the 101 IM Study TDM package assumptions, Scenario A further assumes a 100% increase in the success of trip reduction programs and a consequent reduction in single vehicle trips (from 1,085 to 2,170 trips reduction) in order to test the impact of "optimizing" GHG emissions reduction benefits.

The SBCAG model generated the following GHG reduction benefits for 2035:

- Daily VMT reduction of 128,700 (129,624) or 1.1% of the 2035 baseline VMT
- Reduction of 5,955 vehicle trips or 0.36% of vehicle trips of the 2035 baseline vehicle trips

#### **Additional TDM Strategies**

Scenario A combines similar TDM strategies and options. SBCAG's Traffic Solutions Division has TDM programs to promote alternative modes of transportation, reduce single occupant vehicle commuting, and educate the public on commute alternatives. Included in Scenario A are ongoing and new programs such as Commute Challenge, Traffic Solutions Awareness Programs, and, Dynamic Ridesharing.

- Commuter Challenge – Currently SBCAG's Traffic Solutions Division has two annual Commuter Challenges. These Challenges are one to two month promotions whereby commuters form teams of five, log the days they avoid driving alone and compete against other teams for prizes and recognition. These challenges include an employer to employer competition to spark company team building and motivate employee participation. The friendly competitive and team aspects of the

challenges stimulate conversations, often between people of different social groups, about commuting and also motivates changes in their behavior. These promotions have proven to be very effective at changing long term travel behavior from reliance on single occupant vehicle travel to carpools, transit, bikes or other alternatives. The Commuter Challenges are either for all modes of transportation or for bicycle trips as part of larger promotions such as CycleMAYnia (bike month).

The Commuter Challenge promotions would generate the following new benefits:

- Reduction of 615 daily vehicle trips or 13,545 daily VMT.
- Traffic Solutions Awareness Programs - Traffic Solutions produces and disseminates alternative transportation information to the general public and employers throughout Santa Barbara County. This includes the distribution of bike maps, transit schedules, vanpool, Emergency Ride Home and bicycle safety information at employer fairs, large public events, or via email, newsletters and one-on-one over the 963-SAVE commuter hotline. These individualized marketing strategies provide a means to address individual commuter needs on a case-by-case basis. These individual contacts can result in long term transportation behavior changes thereby reducing vehicle trips and reducing VMT. (Details analysis of benefits is provided in Appendix C )

With the Traffic Solutions Awareness Programs the following GHG reduction benefits can be realized:

- Reduction of 144 vehicle trips and 3,180 VMT per day.
- Dynamic Ridesharing - New smart phone technology has enabled real time instant carpool matching systems that serve individual trips on a case-by-base basis. Where existing online carpool matching systems serve regularly scheduled daily commuter carpooling, the new Dynamic Ride-Matching systems--facilitates carpooling for more unplanned or variable schedule trips (Casual Carpooling). Traffic Solutions plans to launch a Dynamic Ride-matching system in 2011. It is anticipated that this will result in the removal of vehicle trips and VMTs within Santa Barbara County. (Details analysis of benefits is provided in Appendix C )

Dynamic Ridesharing may result in the following GHG reduction benefits:

- An additional reduction of 249 vehicle trips and 5,487 VMT per day on top of what is being modeled.

## **TSM Strategies**

Scenario A also includes the following Transportation System Management (TSM) strategies:

- Bottleneck Relief – Ramp Metering
- ITS - Signalization Synchronization

Bottleneck Relief – Ramp Metering: The ongoing Caltrans Corridor System Management Plan (CSMP) recently evaluated the benefits of implementing a comprehensive ramp metering program on the South Coast Highway 101 corridor between Santa Barbara and Ventura Counties. The CSMP is a comprehensive, integrated management plan using state-of-the-art micro-simulation aimed to analyze solutions to better improve the system efficiency and performance of the 101 corridor with the objective to decrease congestion and improve travel time. The study analyzed the benefits of implementing a system wide ramp metering strategy on 101. Though the report has not been published, SBCAG “piggybacks” on this study’s findings to estimate benefits of GHG emissions

- Micro-simulation analysis of ramp metering from CSMP revealed that this strategy can improve the traffic flow on the freeway, reduce bottlenecks and reduce overall delay where the right conditions exist. For example, queue spill-back detectors are used at ramp locations so that the metering does not result in a disruption of operations to the local arterial system near the ramp.
- According to the ongoing CSMP Study, ramp metering can provide 9% to 13% reduction in delay and in some cases, elimination of bottlenecks. However, the study did not find any reduction in vehicle

trips or VMT and consequently no quantifiable GHG reduction benefits can be observed. More detailed information on the ramp metering analysis is provided in **Appendix C**. However, a ramp metering system often have "pass-by" privileges for carpoolers and buses so as the system expands some time savings benefits occur to these other users and helps to encourage mode shift.

**ITS - Signal Synchronization:** Signal Synchronization is a roadway operational improvement strategy to "smooth out" platoons of vehicles in order to reduce vehicular delays and therefore the emissions. Synchronizing traffic signals on a busy segment of an arterial corridor can improve traffic flow by reducing stop-n-go conditions and increase speeds by at least 5+ mph greater than normal congested speeds during peak periods. Transit vehicles, in particular, would benefit by increased speeds on a busy corridor. SBCAG evaluated two possible candidate locations including Carrillo Street from US101 to Chapala Street and Los Carneros from US101 to El Colegio for signal synchronization. These two locations represent candidate case study examples.

The procedures for computing CO2 emissions benefits for signal synchronization projects follows the methodology in ARB's "Methods to Find the Cost Effectiveness of Funding Air Quality Projects, May 2005." The emissions rates for four passenger vehicle classes from EMFAC and 2035 SBCAG model forecasts and corridor lengths, VMT and CO2 reduction "before and after" project are determined. The analysis provided the following GHG benefits:

- A total daily CO2 emission reduction of approximately 2 tons or 4,094 lbs can be quantified from the above two potential candidate projects in Santa Barbara County.

**Table IV-1** summarizes the total cumulated VMT reduction benefits expected from a combination of the TDM and TSM strategies: As indicated, Scenario A would provide a total of approximately 12,926 million in total VMT for passenger vehicles (LDA, LDT1 & 2, and MDT), reflecting approximately 0.4% drop in total daily VMT reduction when compared to the future 2035 base line forecast.

**Table IV-1: Cumulative Daily VMT Reduction from Scenario A: TDM and TSM**

Scenario A: TDM / TSM for 2035 Horizon Year	VMT (Pax Veh)		
	I-I (100%)	IX-XI @50/50 Split	X-X (0%)
SBCAG 1/	8,199,273	897,164	230,627
SCAG (Ventura Co. & Pts south)		3,050,000	(Discarded)
SLOCOG (SLO Co. & pts north)		801,485	
SubTotal	8,199,273	4,748,649	0
Total VMT from Model TDM measures:			12,947,922
<b>Combines:</b>			
<b>New/Ongoing TDM Promotional/Incentive Programs:</b>			
- Commuter Challenge Programs (post process):			-13,545
- Traffic Solution Awareness Programs (post process):			-3,180
- Dynamic Ridesharing Program (post process):			-5,487
<b>New TSM Strategies:</b>			
- Ramp Metering, (Post Process)			0
- Signal Synchronization: (post process, only generates GHG reduction)			0
<b>TOTAL Daily Cumulated VMT (Countywide):</b>			<b>12,925,710</b>

## **SCENARIO B: Transportation System Improvements and Land Use**

Scenario B contains three elements:

- Transportation System Improvements including expansion of existing transit services and "Commuter Friendly Rail Service" (Amtrak Surfliner) between Ventura and Santa Barbara/Goleta during AM and PM peak periods
- Expansion of Park-n-Ride Facilities
- Land Use – Effects of an Employment Reduction and Densification examined in 101 In-Motion

A combination of SBCAG modeling plus a post processing approach was employed to estimate the GHG reduction benefits.

### **Transportation System Improvements (TSI)**

Expansion of Existing Transit Service: The existing transit system refers to the base year 2007 transit network from the 2009 RTP. Scenario B assumes that further improvements of the existing transit system frequencies are doubled for all feasible transit services including inter-regional transit operations such as Clear Air Express (CAX), Coastal Express, and all other "trunk line" local transit operations including Santa Barbara Metropolitan Transit District (SBMTD), Santa Maria Area Transit (SMAT), City of Lompoc Transit (COLT), Santa Ynez Valley Transit (SYVT), and Guadalupe Flyer (GF). Frequency expansion is assumed to be on the routes that have the highest ridership and/or most popular, i.e., express and trunk routes. Detailed adjustments by specific transit routes and other technical assumptions are detailed in Appendix B.

Expansion of Commuter Friendly Rail Service (Surfliner) between Ventura and Santa Barbara/Goleta: As part of the 101 IM Study, the current SBCAG Model incorporated the "Commuter Rail" trip reduction as a "turn on/off" option. Turning the option "on" assumed that there would be a total of 385 vehicle trips reduced as a result of the implementation of a dedicated Commuter Rail option during each AM and PM peak as defined in the 101 IM Study. However, a dedicated commuter rail service cannot be funded.

The recent draft CSMP Report assumed a modified version of a "commuter friendly" Amtrak Intercity Rail service. The study was based on the need to reflect Amtrak pricing, which is higher than Metrolink for the same trip, lower reliability, due to a larger service area, and, other research such as a recent Chicago study that indicated fewer potential riders absent a dedicated service. The CSMP report proposed that a modified commuter friendly rail service (vs. dedicated commuter rail) results in 285 vehicle trips reduced (73.9% of what was assumed in the 101 In-Motion Report) for the year 2023.

In the 2035 horizon year, SBCAG further assumes that re-scheduling and/or adding new train service to cater to increasing Intercity Passenger Rail service demand, including commuters, between Ventura and Santa Barbara during AM and PM peak periods would result in additional demand and commuter riders. This increasing demand and regular addition of new equipment and services to meet this demand has been documented in the past years and expected in the future as documented in the State Rail Plan and Amtrak Strategic Plan. For Scenario B, it is therefore assumed that the amount of trips reduced resulting from the commuter friendly rail service (Surfliner) expansion between Ventura and Santa Barbara/Goleta by 2035 would potentially serve to reduce 385 trips for each AM and PM peak, i.e., back to the original 101 In-Motion's assumption of 385 trips reduction. More detailed discussion is provided in **Appendix C**.

The following are preliminary results of modeling a combination of Transit Service Improvements plus the expansion of commuter friendly rail service<sup>1</sup>:

- Total daily VMT reduction of 0.06% (or 7,184 VMT) compared to 2035 baseline VMT
- An increase of 8.1% (or 3,129) daily ridership (boardings) compared to 2035 baseline ridership

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<sup>1</sup> The model results may deviate slightly as a result of newer model input and re-runs based on the CSMP results.

Expansion of Park-n-Ride Facilities: The existing park & ride (P&R) facilities within Santa Barbara County reduce approximately 385 trips per day. This figure is based on vehicle counts conducted during 2009 site visits. This trip reduction equates to a reduction of approximately 11,556 daily VMT (**Table C5, Appendix C**).

The public has expressed a need for additional P&R facilities. SBCAG has not yet studied such need; however, several potential locations for new P&R facilities have been identified (**Table C6 in Appendix C**). Assuming these facilities are developed by 2035, and will each serve approximately 20 users (the average number of vehicles served by Santa Barbara County's P&R facilities, excluding Clean Air Express (CAX) lots and peripheral South County lots), they will help reduce an additional 140 trips.

The expansion of Park-n-Ride facilities would result in the following GHG reduction benefits for 2035:

- Approximately 0.03% or 551 vehicle trips reduced in 2035
- Approximately 0.2% or 24,688 daily passenger vehicle VMT reduced in 2035.

## Land Use

### 101 In Motion: Effects of Reduction in Growth and Increased in Employment Density Increase on Regional Travel

Scenario B also attempts to investigate land use strategies and policy measures that would affect single occupant vehicular trips to achieve GHG reduction benefits. Potentially effective land use strategies include development of higher density residential, infill development, regional and subarea redevelopments, and deployment of "4-D" (Density, Diversity, Design, and Destination) strategies. All these strategies have the potential to generate significant GHG emissions reductions in the long-term. However, many of these land use strategies and modeling capabilities have yet to be examined or developed by SBCAG. SB375, however, provides a new opportunity for further development of a SBCAG Land Use Model to allow the capability to analyze alternative land use strategies. The SBCAG's Model Improvement Plan recently submitted to the California Strategic Growth Council has detailed work tasks outlining the land use model development under the "short-(2011-12) and medium-term" (2012-14)<sup>2</sup>.

Given the time constraint of submitting this report to ARB for target setting, SBCAG utilizes a past modeling effort developed for 101-In Motion that examined a scenario that forecasted less growth but concentrated that growth in existing developed areas in the Goleta area. The overall objective was to assess the significance of this change on the need for and phasing of improvements to the regional highway system.

A growth scenario was hypothesized that there would be no further increases in vacant land devoted to housing or employment in the western area of the South coast (in the Goleta area), but rather jobs would increase based on increased density at existing job sites and household population would increase based on more people per household due to higher household density. In addition, the overall growth in population and employment is substantially less (approximately 75% less) than assumed in the SBCAG 2002 Regional Growth Forecast 2000-2030. A full discussion of the assumptions and population and employment information is provided in **Appendix C**.

The following summarizes the study findings:

- The previous (2005) study in 101 In Motion for the Goleta area indicated that trips could be reduced by 2 to 4% of peak hour on the east side of Santa Barbara (between Milpas and the county line) and approximately 5-7% west of Santa Barbara. In particular, approximately 20% of peak hour trip reduction could occur on the 101 segment between Patterson and Glen Annie Road. Using this information, the total VMT reduction is estimated to be approximately 21,000 for 2035.

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<sup>2</sup> SBCAG Model Improvement Plan, March 2010.

- Existing congestion problem in the eastern portion of the Highway 101 corridor would not be alleviated, but a significant reduction in the rate of new development occurring in the west end of the corridor may delay the need for major highway capacity improvements in the Goleta area.
- There is evidence that a significant reduction of vehicle trips due to reduction in employment growth and its concentration would reduce the traffic growth on the west end of the South Coast Highway 101 corridor significantly (approximately 20%) and also improve the freeway level of service by at least one service level (LOS E/F to LOS D/E) by 2030/2035 timeframe.
- Since the greatest amount of development potential in the South Coast is in the west end of the Highway 101 corridor, this area has the potential to be most significantly affected by significant changes in future land use. The study determined that a significant change in local build out potential and rate of employment growth and development could impact the extent and timing of the need for new infrastructure improvements in the western portion of the corridor.

**Table IV-2:** summarizes the cumulative effects of GHG Reduction benefits for Scenario B - Transportation System Improvements and Land Use Alternative:

**Table IV-2: Cumulative Daily VMT Reduction from Scenario B: TSI and Land Use**

Scenario B: TSI and Land Use for 2035 Horizon Year	VMT (Pax Veh)		
	I-I (100%)	IX-XI @50/50 Split	X-X (0%)
Transit Service Impr. & Rail Service Expansion	8,204,216	910,536	230,627
SCAG (Ventura Co. & Pts south) 2/		3,050,000	(Discarded)
SLOCOG (SLO Co. & pts north) 3/		801,485	
SubTotal	8,204,216	4,762,021	0
Total VMT from Model TSI Strategies:			12,966,237
Combines:			
- Park-n-Ride Facilities Expansion: (post process)			-26,737
- Test Reduction in Growth + Employ't Density Incr. in the Goleta area			-21,000
<b>TOTAL Daily Cumulated VMT (Countywide):</b>			<b>12,918,500</b>

## **SCENARIO C: Pricing and Disincentives**

### **Congestion Pricing and VMT fees**

Pricing and disincentives strategies such as "congestion pricing" and "VMT fees" such as high occupancy toll (HOT) do not appear to be feasible for Santa Barbara County. According to the 101 In-Motion Study, the projected HOV volumes by 2030 are so high (over 1,600 vph) during the AM and PM peak hours that there would be little available capacity in the dedicated HOV lane to allow single occupant vehicles (SOV), paying a toll, to use the HOV lane, if it was a HOT lane. Charging a fee to single occupant vehicle users to access an HOV lane will not be successful if the lane is at capacity. In addition, the county has had an historically high percentage of car poolers and the relative distance of the HOV lane is comparatively short. In the context of the Highway 101 corridor through the South coast, the study does not indicate that HOT lanes would be viable as a long-term means of reducing congestion or for paying for the capital costs of adding the lanes. HOV lanes on the other hand could be expected to be well utilized during the peak hours.



### **Parking Pricing**

The parking pricing strategy is also generally unrealistic for mid- to small-size MPOs like SBCAG since relatively few agencies even charge for parking. In Santa Barbara County, only the City of Santa Barbara, Santa Barbara City College, and the University of California, Santa Barbara (UCSB) currently charge for parking.

However, the draft City of Santa Barbara General Plan (PlanSB) examined the effects of parking pricing as one of their alternates to evaluate the impacts on trip reduction in Downtown Santa Barbara. Thus, SBCAG is testing its effects on countywide GHG reduction benefits as an example of a Pricing and Disincentives scenario.

Utilizing the parking pricing provisions available from PlanSB and applying them in the SBCAG model and the 2035 travel flows for downtown Santa Barbara area, the following GHG reduction benefits were quantified: (Technical details are provided in Appendix C:

- For parking policy provisions under PlanSB Alt. 1, approximately 97,700 fewer VMT is calculated in 2035, which ranges between 0.9% and 0.6% less GHG per capita based on Pavley adjustments.
- For parking policy provisions under Plan SB Alt. 2, approximately 172,000 fewer VMT is calculated in 2035, which ranges from 1.5% to 0.9% less GHG per Capita, based on Pavley adjustments.

## V. Cumulative Estimate of GHG Reductions

### Overview

Tables V-1 provides a summary comparison the overall GHG reduction benefits for the 2035 horizon year when compared to the 2005 baseline. This information is from the SBCAG travel model supplemented with post processing (off-model) adjustments. The results also include the daily CO2 emissions per capita with and without Pavley adjustments plus their relative percentage reduction of GHG (CO2) emissions without and with Pavley adjustments.

It should be recognized that the technical analyses contained in this report and the resulting GHG reduction information are limited to the extent of the current capability of the SBCAG travel demand model. Equally important, the GHG reduction strategies and policy options incorporate "broad" assumptions and "post processing" techniques which are subject to ongoing review. The resulting findings represent the best estimate of forecast growth in traffic projections (trips and VMT), but the "best-case", i.e., the maximum GHG reduction benefits, scenario in terms of accomplishing RTAC's recommendations of "ambitious and achievable" given the time constraints for ARB target setting in June 2010. As indicated in the SBCAG Model Improvement Plan, the SBCAG will continue to enhance and develop new capabilities in modeling to help model more accurately GHG emissions for Santa Barbara County. In addition SBCAG will be able to examine some issues such as the impacts of land use alternatives on GHG production during its development of the Sustainable Community Strategy required by SB-375.

### 2035 Cumulative GHG Reductions

Table V-1 Table V-2 provides individual planning scenario ranking.

**Table V-1: Comparison of GHG Reduction Benefits between 2005 and 2035**

Evaluation Criteria (2005 Baseline vs. 2035 Horizon Year)	2005	2035	Increase/ Decrease	% Increase / Reduction
Daily VMT	10,798,464	12,978,263	2,179,799	20.2%
Daily GHG Emissions (Tons) (No Pavley Adj.)	4,643.34	5,515.76	872.42	18.8%
Daily GHG Emissions per Capita (lbs) (No Pavley/ LCF Adj.)	22.24	22.62	0.38	1.7%
Daily GHG Emissions per Capita (lbs) (with Pavley Adj.)	22.24	14.62	-7.63	-34.3%

### Individual Planning Scenario Summary

Table V-2 provides a comparison of all three alternative planning scenarios. Description of the alternative and more detailed findings are also provided.

**Table V-2: Individual Planning Scenario Evaluation**

Planning Scenarios	Ranking	No Pavley/LCF Adj.	With Pavley LCF Adj.
		Daily GHG Emissions Per Capita	Daily GHG Emissions Per Capita
Alternative A: TDM & TSM	1st	22.53 lbs	14.56 lbs
Alternative B: TSI & Land Use	2nd	22.52 lbs	14.55 lbs
Alternative C: Pricing & Disincentives	3rd	22.30 lbs	14.40 lbs

#### Scenario A: TDM and TSM Alternative

- Total daily vehicle trips = 1.658 million, representing a reduction of 5,955 (or 0.36%) daily vehicle trips
- Total daily VMT = 11.313 million, representing a reduction of 128,700 (or 1.1%) total daily VMT
- Reduced 0.09 lb daily CO2 per Capita with no Pavley adj. (22.53 lbs vs. 22.62 lbs for 2035 baseline)
- Reduced 0.06 lb daily CO2 per Capita with Pavley adj. (14.56 lbs vs. 14.62 lbs for 2035 baseline)
- No quantifiable effect on transit (person) trips

#### Scenario B: TSI and Land Use Alternative

- Total daily vehicle trips=1.661 million, representing a reduction of 0.1% (or 2,234) daily vehicle trips
- Total daily VMT=11.435 million, representing a reduction of 0.06% or 7,184 daily VMT
- Reduced 0.01 lb daily CO2 per Capita with no Pavley adj. (22.52 lbs vs. 22.62 lbs for 2035 baseline)
- Reduced 0.07 lb daily CO2 per Capita with Pavley adj. (14.55 lbs vs. 14.62 lbs for 2035 baseline)
- Increased 1,956 transit (person) trips (31,077 vs. 29,121 transit (person) trips for 2035 baseline)
- Increased 3,129 ridership (boardings) or 8.1% when compared to 2035 baseline
- Signal synchronization improvements would provide an additional 4,094 lb daily GHG reduction or 0.01 lb daily CO2 reduction per Capita (with no Pavley adj.)
- Land use scenario tested in 101 In Motion: Total VMT reduction is estimated to be approximately 21,000 daily vehicle trips.

#### Scenario C: Pricing and Disincentives Alternative

This scenario assesses parking pricing policy options proposed in the draft City of Santa Barbara's General Plan, Plan Santa Barbara (PlanSB). The information was based on the information provided by the City of Santa Barbara with the application of post process techniques to evaluate the GHG reduction benefits.

The following GHG reduction benefits were quantified utilizing the parking pricing provisions available from PlanSB and applying them in the SBCAG model and the 2035 travel flows for downtown Santa Barbara area, (Technical details are provided in Appendix C):

- For parking policy provisions under PlanSB Alt. 1, approximately 97,700 VMT reductions would be expected in 2035, reflecting approximately 0.9 and 0.6% of GHG reduction per Capita without and with Pavley adjustments.
- For parking policy provisions under Plan SB Alt. 2, approximately 172,000 VMT reductions would be expected in 2035, reflecting approximately 1.5% and 0.9% of GHG reduction per Capita without and with Pavley adjustments.

Table V-3 summarizes the GHG emission reductions for the 2035 horizon year for the alternative scenarios and discrete measures. The reference to "post processing" refers to the off-model techniques to estimate GHG reductions in areas where SBCAG model lacks capability or insensitive to a policy or factor. The adjustments are based on research inputs plus professional judgments to manually quantify the result. Those strategies that use post processing approach are documented in the Appendices.

As indicated in Table ES-3, total GHG emissions reduction by combining all strategies and options results in just 0.5 lbs per capita emission reduction by 2035 without Pavley adjustments. The total GHG emission per capita would be about 22.12 lbs (22.62 from 2035 baseline less 0.5 lbs cumulative emission reduction).

Table V-4 includes a detailed presentation of travel forecasts for base and horizon years by type of trip and an assessment of GHG reductions for each of the scenarios.

**Table V-3: Summary GHG Emissions Reduction for 2035 Forecast and Alternative Planning Scenarios**

2035 Forecast and Alternative Planning Scenarios	Methodology	Vehicle Trips	VMT (Pass. Vehicles) 2/	Daily GHG Emissions Per Capita (lbs) (No Pavley Adj.)	Other Benefits
2005 Baseline (Modeled)	Model	1,331,802	10,798,463	22.24	
2035 Horizon Year (Modeled)	Model	1,663,729	12,978,262	22.62	
		Vehicle Trips Reduction	VMT Reduction (Pass. Vehicles) 2/	Daily GHG Reduction per Capita (No Pavley Adj.)	Other Benefits
<b>Scenario A: TDM / TSM</b>					
1. 101 In-Motion (TDM Package Option)	Model	5,955	128,700	0.07	
2. Commuter Challenges	Post Process	615	13,545	Inclusive	
3. Traffic Solutions Awareness Programs	Post Process	144	3,180	Inclusive	
4. Dynamic Ridesharing	Post Process	249	5,187	Inclusive	
5. Bottleneck Relief - Ramp Metering	Post Process	NA	NA	NA	Reduce delays, increase safety
6. Operational - Signal Synchronization	Post Process	NA	NA	0.01	Reduce a total daily GHG of 2 tons, reduce peak
<b>CUMULATIVE</b>		<b>6,963</b>	<b>150,612</b>	<b>0.08</b>	
<b>Scenario B: TSI and Land Use</b>					
1. Expand Transit System Services	Model	2,234	7,184	0.1	Increase 3,129 daily boardings
2. Expand Park-n-Ride Facilities	Post Process	551	26,737	Inclusive	
3. Expand Commuter-Friendly Train Rail Service	Model	Inclusive	Inclusive	Inclusive	
4. Land use (Employ't Reduction & Densification)	Post Process	NA	21,000	Inclusive	Reduced 2-7% vehicle trips on 101 during peak hour.
<b>CUMULATIVE</b>		<b>2,785</b>	<b>54,921</b>	<b>0.1</b>	
<b>Scenario C: Pricing and Disincentives</b>					
1. Parking Pricing Case Study 3/	Post Process	28,762	172,000	0.32	
<b>CUMULATIVE REDUCTION (A+B+C)</b>		<b>38,510</b>	<b>377,533</b>	<b>0.50</b>	

1/ Based on SBCAG Modeled output and include XX trips

2/ Based on a 50/50% Split IXXI approach and include 50% neighboring IXXI VMT.

3/ Based on PlanSB Alt 2.

## Findings and Conclusions

- Preliminary analyses of the alternative planning scenarios indicates that the potential of these measures on GHG reduction is relatively small (less than 1% of VMT and GHG reduction) for the 2035 horizon year, and even less for the 2020 interim year, if the Pavley/LCF adjustments were not taken into consideration.
- Pavley and LCF adjustments will offer significant reductions to GHG production in future years.
- The parking pricing example has indicated significant potential in achieving GHG reduction benefits. However, since only three institutions in Santa Barbara County (the City of Santa Barbara, Santa Barbara City College, and UCSB) charge for parking, this alternative has limited applicability at this time for Santa Barbara County.
- The TDM alternative remains the best approach to reduce GHG emissions in the future since small changes in individual behavior can result in cumulative reductions in single occupant vehicle trips and vehicle miles traveled.

- At this time for the SBCAG region, technology advances and improvements in vehicle performance and fuel efficiency coupled with TDM strategies remain the best approach to reduce future GHG emissions.
- While transit system improvements examined alone appear to have limited GHG reduction benefits, the analysis by other MPOs indicate the combination of supportive land uses and fare policy options can achieve beneficial results. The effect of changes in land use on future emissions is yet to be determined and will be assessed during the development of the Sustainable Communities Strategy as part of SBCAG's response to SB-375.

**Table V-4: Summary of GHG Emissions Reduction Results for SBCAG Alternative Planning Scenarios**

SBCAG VMT & GHG Emissions	(2009 RTP)		SBCAG Forecasts				SBCAG Alternative Planning Scenarios (2035)		
	2000	%	2005	2020	2035		Scenario A TDM & TSM	Scenario B TSI/Land Use	Scenario C Pricing & Disincentives
VMT for Pax Veh (LDA, LDT1, LDT2, MDV)									
Internal (I-I) Modeled	7,893,682	77.5%	6,986,773	8,086,605	8,213,688		8,199,273 (22,212)	8,204,216 (47,737)	8,213,688 (172,000)
Post-processed VMT reductions (other strategies) 1/									
Total Internal (I-I) VMT	7,893,682		6,986,773	8,086,605	8,213,688		8,177,061	8,156,479	8,041,688
Total Interregional (IX-XI) VMT	2,290,233	29.0%	3,811,691	4,521,674	4,764,575		4,748,649	4,762,021	4,748,649
Total Through (X-X) VMT (discarded)	45,600	2.0%	152,002	187,185	230,627		230,627	230,627	230,627
TOTAL VMT (I-I) + (IX-XI)	10,183,915		10,798,464	12,608,279	12,978,263		12,925,710	12,918,500	12,790,337
Population: SBCAG 07RGF	399,300	399,300	417,500	459,600	487,600		487,600	487,600	487,600
Weekday CO2 (Tons) Ton = 2000 lbs									
Internal I-I	3,354.81	3,344.91	3,004.31	3,436.81	3,490.82		3,475.25	3,466.50	3,417.72
Interregional IX-XI	973.35	970.48	1,639.03	1,921.71	2,024.94		2,018.18	2,023.86	2,018.18
Through X-X (Discarded)	19.38	19.32	65	80	98		98	98	98
TOTAL (I-I + IX-XI), No Pavley/LCFS Adj. (Tons)	4,328.16	4,334.71	4,643.34	5,358.52	5,515.76		5,493.43	5,490.36	5,435.89
Pavley & LCFS adjustment factor	0	0	0	0.742	0.646		0.646	0.646	0.646
TOTAL with Pavley/LCFS adj. (Tons)	4,328.16	4,334.71	4,643.34	3,976.02	3,563.18		3,548.75	3,546.77	3,511.59
Internal I-I	16.80	16.75	14.39	14.96	14.32		14.25	14.22	14.02
Interregional XI-IX	4.88	4.86	7.85	8.36	8.31		8.28	8.30	8.28
Through X-X (Discarded)	0.10	0.10	0.31	0.35	0.40		0.40	0.40	0.40
Daily CO2 per Capita (lbs) - No Pavley/LCFS Adj. (lbs)	21.68	21.61	22.24	23.32	22.62		22.53	22.52	22.30
% CO2 Reduction (No Pavley + LCFS) Compared to 2005BC				4.8%	1.7%		1.3%	1.2%	0.2%
Internal I-I	16.80	16.75	14.39	11.10	9.25		9.21	9.19	9.06
Interregional XI-IX	4.88	4.86	7.85	6.21	5.37		5.35	5.36	5.35
Through X-X (Discarded)	0.10	0.10	0.31	0.35	0.40		0.26	0.26	0.26
Daily CO2 per Capita - With Pavley/LCFS Adj. (lbs)	21.68	21.61	22.24	17.30	14.62		14.56	14.55	14.40
% CO2 Reduction (with Pavley + LCFS) Compared to 2005BC				-22.2%	-34.3%		-34.6%	-34.6%	-35.2%

1/ Based on the "50/50 split" of IX-XI VMT between neighboring MPOs as recommended by Regional Technical Advisory Committee (RTAC).

## **Appendices**

**Appendix A: SBCAG Travel Demand Model, an Overview**

**Appendix B: Future controls on GHG Emissions from Passenger Vehicles**

**Appendix C: Planning Scenarios, Methods and Assumptions**

### **Scenario A: TDM and TSM Alternative**

- Rideshare, Individual Marketing, Flex Work
- Bike and Walk Program
- Traffic Solutions Awareness and Incentive Program
- Ramp Metering
- ITS, Signal Synchronization

### **Scenario B: TSI and Land Use Alternative**

- Transit System Improvements, Park and Ride Facilities
- Commuter Friendly Passenger Train Service Expansion
- Land Use – An Example of the Impacts of lowering employment growth and increasing density on Regional Travel

### **Scenario C: Pricing and Disincentives Alternative**

- Parking Pricing – An Example Using “*Plan Santa Barbara Public Parking Pricing Policies*”

## **Appendix A:**

### **SBCAG Travel Demand Model – An Overview**

SBCAG currently maintains a countywide regional travel demand model (SBCAG Model). Staff applies and maintains the model in-house and works in close cooperation with state, regional and local agencies to forecast traffic growth, assess demand for transportation infrastructure improvements, evaluate corridor alignment alternatives, and in the recent past, when SBCAG was designated as a federal ozone non-attainment area, determine air quality conformity between the SBCAG Regional Transportation Plan (RTP) and Federal Transportation Improvement Program with our County SIP.

The SBCAG model is a traditional 4-step trip-based model. The four main models are trip generation, trip distribution, mode choice, and assignment. The model domain consists of Santa Barbara County plus the two neighboring counties of Ventura and San Luis Obispo. A total of 268 internal (Santa Barbara County) zones are augmented by 5 external zones from San Luis Obispo County in the north and eight external zones from Ventura County in the south. Eight trip purposes model various trip making characteristics, including home-based work (HBW), home-based shop (HBSh), home-based school (HBSc), home-based other (HBO), non-home-based work (NHBW), non-home-based other (NHBO), visitors (VIS), and Internal-External/External-Internal (IX-XI) trips. Trip production and attraction are matched and balanced in the Trip Generation module. Trip Distribution is conducted through the use of a gravity model.

The network contains a comprehensive highway and transit network systems. The highway network contains over 11,000 roadway links and 4,000 nodes grouped under various functional classifications based on area and facility type.

A multi layer logit mode choice model is employed to analyze and predict choices of travel mode. The nested structure allows daily persons trips to be modeled more precisely by various sub-modes. Initially, person trips are separated by motorized and non-motorized modes. The next layer further separates motorized trips into auto, carpool and transit and non-motorized modes into bike and walk trips. Transit trips are modeled under local and express bus sub-modes. They are then sub-divided under Park-and-Ride and Kiss-and-Ride sub-modes. Carpool trips are modeled under 2-person and 3+ persons. Auto occupancy is used to transform highway person trips into vehicle trips. One of the mode choice output is the bike and walk trips.

Once transit trips are estimated, they are assigned to a transit route network, a comprehensive route structure developed for eight types of transit services provided by five major transit operators who deliver transit services in the County. This network also includes two inter-county transit services operated by transit agencies outside the county. The transit database incorporates information on transit operators, their respective route systems, ridership, frequency, route stops, fares and other transit accessibility parameters. Transit trips are assigned on the transit network for assignment. The model output is daily and annual ridership (boardings).

The SBCAG Model employs a socioeconomic, distinct from land use, data-base. The model database consists of a variety of data including households, employment, household size, income, plus a number of special generators such as UCSB, the Vandenberg Air Force Base (VAFB), the US Penitentiary at Lompoc, state parks, beaches, and other tourist attractions within the county, plus the entire spectrum of the 2000 Census database. The employment data was developed from the nationwide InfoUSA database and was refined and redistributed by TAZs based on local input, research, and field surveys to ensure accuracy for the 2000 base year.

The 2001 Caltrans Household Travel Survey for Santa Barbara County provides crucial travel information on trip purpose, modes, trip lengths, frequency, and other travel characteristics including time-of-day (TOD) distributions for model calibration and validation. In cooperation with local jurisdictions SBCAG conducts an annual traffic count program to support travel forecasting and traffic monitoring activities. These data are used in validating the model to examine how closely the model replicates base year conditions. The Traffic



Solutions Division of SBCAG also conducts a voluntary employee commuter surveys every three years to promote ride sharing and this data is also used to support model validation.

Peak hour traffic is modeled under 3 time periods (AM, PM and Midday). The AM peak models the portions of the day from 7 AM to 8 AM. PM peak traffic is modeled from 4 PM to 5 PM, and Midday peak is modeled from 12 noon to 1 PM. Time-of-Day distribution is used to estimate daily traffic under an average weekday. Highway speed and capacity look-up tables are developed based on the Highway Capacity Manual (HCM), with adjustments based on local geographic conditions. Delay is modeled using standard BPR equations.

Vehicle trips are assigned to specific paths on the highway network in the assignment process. The user equilibrium method is employed with a Multiple Successive Averages (MSA) approach for calculation of "congested" speeds. Three feedback loops are performed to feed congested speeds from Assignment back to Trip Distribution. A convergence criteria (relative gap) set at 0.001 or 50 iterations whichever comes first is employed to assure convergence.

In 2007 as part of the 101 In-Motion Study, the SBCAG Model capabilities were significantly enhanced. A "High Occupancy Vehicle (HOV)" lane modeling capability was added. A Multi Modal Assignment (MMA) approach is employed in order to more accurately model traffic demand on the planned HOV improvements on Highway 101. In addition, traffic demand management (TDM) modeling assessment capabilities were incorporated to evaluate TDM measures as recommended in the 101 In-Motion corridor study. This included enhanced expressed bus, telecommuting, flexible work schedules as well as the analyzing the effects of implementing an enhanced commuter rail option between Ventura, Santa Barbara and San Luis Obispo counties.

Currently the SBCAG Model is used for long range forecasts, plan development, and air quality analysis. A post-process procedure is used to determine congested link speeds by speed class for conformity and air quality analysis. The post-processor interfaces with the latest ARB's air quality model (EMFAC2007) to determine vehicular emissions for base and future years for alternative RTP scenarios.

The SBCAG model runs on the TransCAD platform. "Trafix" software from Dowling Associates is used to supplement the analytical capability for intersection level of service analyses under the Congestion Management Program (CMP). The SBCAG Model is maintained in-house with continuing refinements. However, SBCAG relies on consulting assistance for major updates.

Additional information about the SBCAG Model structure, model calibration and validation procedures, and traffic forecasts are available in the document entitled "The 2030 Travel Forecast for Santa Barbara County, Final Report, and September, 2004". The report is available in the publication section of the SBCAG website.

The current SBCAG Model is based on the 2002 Regional Growth Forecast (02'RGF). Staff is currently updating the SBCAG Model from the 2000 to 2005 base year. The model update will also use the new adopted 2007 RGF with long range travel forecasts projected to the year 2040. The year 2005 will be the new base year per recommendations by the RTAC.

## **Appendix B:**

### **Future Controls on GHG Emissions from Passenger Vehicles**

This section estimates the effects of the Pavley emission standards and the Low Carbon Fuel Standard.

The California Air Resources Board (CARB) has passed into state law two measures that attempt to reduce GHG emissions from passenger vehicles.

State Control Measure	Description
Pavley Phases I & II GHG Emission Standards for Light-Duty Vehicles	The Pavley standards seek to reduce GHG emissions from light-duty vehicles to the maximum extent technologically feasible. ARB is currently enforcing the Phase I standards for model years 2009 and up. The standards will be strengthened under Phase II starting in 2012.
Low Carbon Fuel Standard (LCFS)	California's LCFS requires fuel providers to reduce the carbon intensity of transportation fuels sold in the state, dramatically expanding the market for alternative fuels. To start, the LCFS will reduce carbon content in all passenger vehicle fuels sold in California by at least 10 percent by 2020 and more thereafter.

### **CARB Post-Processing Tool**

CARB's air quality model, EMFAC, was developed prior to approval of the Pavley and Low Carbon Fuels (LCFS) and does not assume any GHG reduction legislation in place for the future years. In order to account for emission reductions in future years for the Pavley and LCFS, CARB staff developed a post-processing tool that can be used with the EMFAC output to account for both of these regulations. The tool was obtained via the CARB website <http://www.arb.ca.gov/cc/sb375/tools/postprocessor.htm>.

The Pavley I + LCFS Post Processor (Version 1.0) was developed to adjust the carbon dioxide (CO<sub>2</sub>) emissions from the EMFAC output to account for the reductions from the adopted Pavley I regulation and LCFS on the light duty fleet only:

- Passenger Cars (LDA)
- Light Duty Trucks (LDT1) (0 – 3,750 lbs)
- Light Duty Trucks (LDT2) (3,751 – 5,750 lbs)
- Medium-Duty Trucks (MDT) (5,751 – 8,500 lbs)

The postprocessor is designed to work as a standalone Microsoft Windows-based program that is applied to the EMFAC "Burden" output to calculate the adjusted CO<sub>2</sub> emissions. The post-processor is coded as a Microsoft Office Excel Macro to automate the calculations and includes a Visual Basic interface so that users can execute the macro as a Windows program.

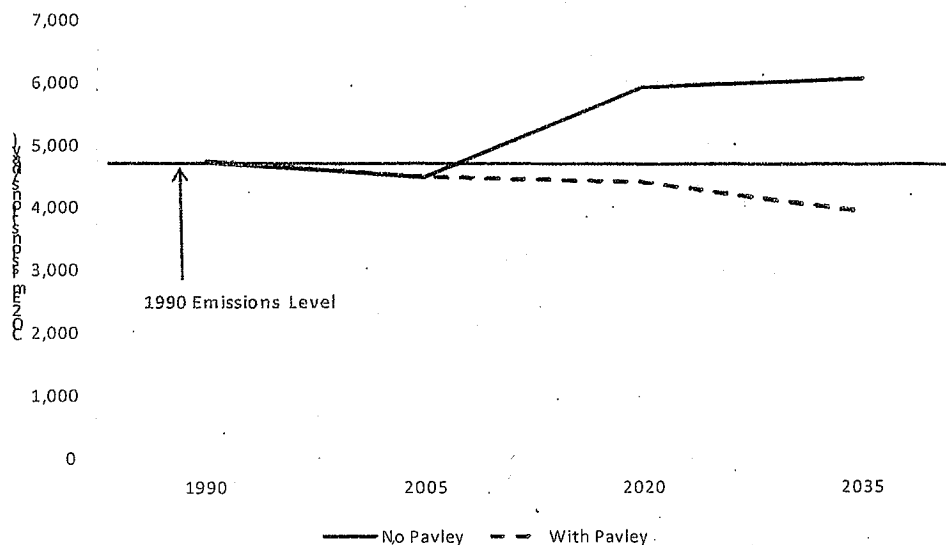
### **Emissions Testing on SB County Passenger Vehicle Fleet**

Staff obtained the post-processor in order to test the effects of Pavley and LCFS on Santa Barbara County inventory of passenger vehicles. The post-processor was tested using the SBCAG travel demand data in the EMFAC model. This is the same travel demand data used in the 2009 RTP, which utilized demographic data from SBCAG's 2002 Regional Growth Forecast to estimate future travel demand.

The air quality model was run for the years 1990, 2005, 2020, and 2035. Then, the 2020 and 2035 output was fed into the Pavley post-processor to determine the effects of the Pavley/LCFS control measures. The CO<sub>2</sub> emissions for each of the scenario years are shown in the table and chart below.

# **SB County CO2 Emissions with Pavley and LCFS Control Measures**

Scenario Year	SB County VMT (LDA+LDT 1 & 2+MDT)	CO <sub>2</sub> Emissions (1,000 tons / day)	
		No Pavley/LCFS	With Pavley/LCFS
1990	8,895,000	4,730	--
2005	10,054,000	4,480	--
2020	13,482,000	5,920	4,395
2035	13,937,000	6,050	3,906



As shown, implementation of the state control measures will significantly reduce CO<sub>2</sub> emissions in the future years. Staff will continue to use the post-processor for formal air quality analysis in the future. For more rapid scenario testing of CO<sub>2</sub> emissions, staff developed Pavley/LCFS adjustment factors using the analysis outlined above:

## **Pavley/LCFS Adjustment Factors for SB County**

Scenario Year	CO <sub>2</sub> Emissions (1,000 tons per day)		Adjustment Factor
	No Pavley/LCFS	With Pavley/LCFS	
2020	5,920	4,395	0.742
2035	6,050	3,906	0.646

## Appendix C:

### Planning Scenarios, Methods and Assumptions

#### SCENARIO A: TDM and TSM Alternative

##### TDM Strategies:

Table C-1: Scenario A: Modeling and/or Post Processing Approaches and Assumptions

TDM	Modeling or Post Process	Deployment Level		
		2005 (Baseline)	2020 (Moderate)	2035 (Aggressive)
Rideshare, Individual Marketing, Flex Work, Telecommute, and Vanpool	Expand SBCAG Model's TDM Option by modifying the 101 IM Study TDM Package Option, Run Model	Run Model: 2005 Base Year Forecast	Interpolate model VMT results from 2035 Model Run to estimate benefits.	Run Model: Assumed 100% increase in daily vehicle trips reduction (from 1,085 to 2,170)
Commuter Challenge, Traffic Solutions Awareness Programs, and Dynamic Ridesharing	Post Process	No applied	Interpolate vehicle trip and VMT reductions as estimated by SBCAG Traffic Solutions.	Estimate vehicle trips and VMT reduction as estimated by Traffic Solutions.

The current SBCAG model already incorporated the TDM modeling capability from the 101 In-Motion Study. This is a "turn-on or -off capability" in the model. The TDM measures incorporated in the model include rideshare, individual marketing, and flexible work which assumed a reduction of approximately 1,085 vehicle trips during each AM and PM peak hour as analyzed in the 101 IM Study. Under Scenario A, the following new assumptions were employed:

- Expand 101 IM Study TDM Trip Reduction – In addition to the 101 IM Study TDM package assumptions, Scenario A further assumes a 100% increase in the success of trip reduction programs and a consequent reduction in single vehicle trips (from 1,085 to 2,170 trips reduction) in order to test the impact of "optimizing" GHG emissions reduction benefits

The SBCAG model generated the following GHG reduction benefits for 2035:

- Daily VMT reduction of 128,700 (129,624) or 1.1% of the 2035 baseline VMT
  - Reduction of 5,955 vehicle trips or 0.4% of vehicle trips of the 2035 baseline vehicle trips
- Commuter Challenge – Currently SBCAG's Traffic Solutions Division has two annual Commuter Challenges. These Challenges are month to two month promotions whereby commuters form teams of five, log the days they avoid driving alone and compete against other teams for prizes and recognition. These challenges also include an employer to employer competition to spark company team building and motivate employees to participate. The friendly competitive and team aspects of the challenges stimulate conversations between people of different social groups about commuting and motivates changes in their behavior. These promotions have proven to be very effective at changing long term travel behavior from SOV use to sustainable transportation modes. The Commuter Challenges are either for all modes of transportation or for bicycle trips as part of larger promotions such as CycleMAYnia (bike month).

As a result of post process, the Commuter Challenge promotions would generate the following new benefits:

- An additional reduction of 615 daily vehicle trips or 13,545 VMT per day on top of what is being modeled.

- Traffic Solutions Awareness Programs - Traffic Solutions produces and disseminates alternative transportation information to the general public and employers throughout Santa Barbara County. This includes the distribution of bike maps, transit schedules, vanpool, Emergency Ride Home and bicycle safety information at employer fairs, large public events, or via email, newsletters and one-on-one over the 963-SAVE commuter hotline. These individualized marketing strategies provide a means to address individual commuter needs on a case-by-case basis. These individual contacts can result in long term transportation behavior changes thereby reducing vehicle trips and reducing VMT. (Details analysis of benefits is provided in Appendix C)

Based on the post process analysis, the following GHG reduction benefits can be realized:

- An additional reduction of 144 vehicle trips and 3,180 VMT per day on top of what is being modeled.

- Dynamic Ridesharing - New smart phone technology has enabled real time instant carpool matching systems that serve individual trips on a case-by-base basis. Where existing online carpool matching systems serve regularly scheduled daily commuter carpooling, the new Dynamic Ridematching systems facilitate carpooling for more unplanned or variable schedule trips (Casual Carpooling). Traffic Solutions plans to launch a Dynamic Ridematching system in 2011. It is anticipated that this will result in the removal of vehicle trips and VMTs within Santa Barbara County. (Details analysis of benefits is provided in Appendix C.

Based on the post process analysis, the following GHG reduction benefits can be realized:

- An additional reduction of 249 vehicle trips and 5,487 VMT per day on top of what is being modeled.

#### Transportation System Management (TSM) Strategies

- Ramp Metering
- ITS, Signal Synchronization

**Table C2: TSM Strategies, Assumptions and Post Processing**

System Efficiency/ TSM	Modeling or Post Process	2005	2020 Moderate	2035 Aggressive
Bottleneck Relief – Ramp Metering	Post process	Not Applied	Interpolate approximate half of the CSMP Study results	Assumed full realization of CSMP Study results
Operation Strategies: Signal Synchronization	Post process	Not Applied	Interpolate approximate half of the post processing results	Assumed implementation of two signal synchronization projects on two major arterial corridor segments.

#### Ramp Metering

As indicated earlier, the SBCAG analysis relies on the most ongoing CSMP Study, a report which has not yet been published by Caltrans District 5. The following information was summarized from the report<sup>3</sup>.

When Freeway demands approach capacity, ramp metering can be used to avoid a breakdown in mainline traffic by breaking up platoons of vehicles arriving from nearby signalized intersections. The primary objective of ramp metering is to minimize or mitigate the impact of recurring bottlenecks on the freeway mainline. The strategy is to spread a thirty second burst of vehicles onto the mainline over a full minute which shorten

<sup>3</sup> Draft Corridor System Management Plan, Chapters 7 and 8, April 2010

delays on the ramp while greatly increasing freeway speeds. By breaking up platoons or groups of vehicles and controlling the entry of vehicles on the freeway, ramp metering may also reduce traffic accidents in merge areas.

Metering effectively transfers excess demand and delays from a mainline freeway bottlenecks to on-ramps. For ramp metering to be most effective, it must be implemented not only at the onramp nearest a bottleneck, but also on a more system-wide basis to multiple on ramps upstream of the bottleneck.

One of the benefits of ramp metering is safety. Ramp metering reduces stop-n-go driving behavior, resulting in fewer rear-end collisions. Breaking up platoons of vehicles entering a freeway, can result in fewer side swipe and related collisions. The CSMP study has indicated that in areas where metering has been implemented, accident rate reductions of 20% to 40% have reported<sup>4</sup>.

#### Effects of Ramp Metering on GHG Reduction Benefits

The CSMP simulation analysis of ramp metering indicates that the strategy can improve the traffic flow on the freeway, reduce bottlenecks and reduce overall delay where the right conditions exist, i.e., queue spill-back detectors are assumed to be in operation in all tests of ramp metering so that the metering does not result in a disruption of operations in all the local arterial system near the ramp. The report has indicated the following findings:

##### AM Peak:

- On 101 northbound, ramp metering results in approximately 9% reduction in freeway delay with no change in freeway volumes or VMT
- On 101 southbound, no significant overall benefits can be observed other than eliminating a bottleneck at Las Positas Road.

##### PM Peak

- On 101 northbound, ramp metering results in approximately 13% reduction in freeway delay with no change freeway traffic volume or VMT
- On 101 southbound, ramp metering produces a significant reduction in delay of 12% while accommodating a slight increase in traffic on the freeway.

Based on the findings of the CSMP draft report, there are no observable benefits of vehicle trips and VMT reduction resulting from the implementation of the ramp metering strategy and therefore no quantifiable GHG reduction benefits.

#### ITS - Signal Synchronization

Signal Synchronization is a roadway operational strategy in which traffic signals on segments of a busy arterial corridor are synchronized to facilitate "smoothing out" of vehicle traveling speed. This strategy is most effective in increasing vehicle speeds during peak periods when traffic is most congested. Transit vehicles in particular receive the greatest benefit by a 5+ miles per hour increase over normal congested speeds on a busy corridor.

SBCAG evaluated two candidate locations in Santa Barbara County where signalization synchronization can provide quantifiable GHG reduction benefits from faster vehicle speeds during peak periods. The two candidate locations include Carrillo Street, from US101 to Chapala Street, and Los Carneros Road, from US101 to El Colegio.

The procedures for computing CO2 emissions benefits for signal synchronization projects follows the methodology in ARB's *Methods to Find the Cost Effectiveness of Funding Air Quality Projects* (May 2005). The emissions rates for four passenger vehicle classes from EMFAC and 2035 SBCAG model

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<sup>4</sup> Freeway Management and Operations Handbook, FHWA, 2003, Revised 2006)

forecasts and corridor lengths, VMT and CO2 reduction "before and after" project are determined. The analysis provided the following GHG benefits:

- A total daily CO2 emission reduction of approximately 2 tons or 4,094 lbs can be quantified from the above two potential candidate projects in Santa Barbara County.

Table A3 presents the calculation of daily CO2 reduction estimates resulting from two potential candidate projects. The total daily CO2 emission reduction of approximately 2 tons or 4,094 lbs can be obtained.

**Table C3: CO2 Reduction Benefits resulting from Signal Synchronization**

Signal Synchronization Corridor	2035 Daily VMT *	Before			After			Daily CO2 Reduced (Pass. Vehicles)	
		Avg. Veh. Speed (mph) **	Emission Rate (gm/mi) ***	CO2 Emissions (tons)	Avg. Veh. Speed (mph)**	Emission Rates (gm/mi)***	CO2 Emissions (tons)	Tons	Lbs
Carrillo St. - US 101 to Chapala	7,306	20	522.043	4.20	25	441.081	3.55	0.7	1,304.0
Los Carneros - US 101 to El Colegio	36,418	30	386.798	15.53	35	352.047	14.13	1.4	2,790.1
<b>Total</b>				<b>19.73</b>			<b>17.68</b>	<b>2.0</b>	<b>4,094.1</b>

\* Corridor length times 2035 AM & PM peak hour volumes.

\*\* May require field study to verify average speed for model input

\*\*\* Based on passenger vehicle emission rates from EMFAC

## SCENARIO B: TSI and Land Use Alternative

Table C4: Scenario B: TSI Alternative and Land Use Assumptions

TSI	Modeling or Post Process	Deployment Level		
		2005 (Baseline)	2020 (Moderate)	2035 (Aggressive)
Coastal Express, SMAT, COLT, Telecommute, and Vanpool	Modify SBCAG Model 's Transit Model by doubling the frequency of trunk line and express transit services; Run Model	No changes in transit services	Interpolate about half of vehicle trips and VMT reduction to estimate GHG benefits.	Model Run: 100% increase in transit service frequency to estimate benefits (ridership and vehicle trips reduction)
Transit station park-n-ride facilities	Post Process	applied	Interpolate about half of vehicle trips and VMT reduction to estimate GHG benefits.	Estimate vehicle trip and VMT reduction estimated by Traffic Solutions.
Friendly Commuter Rail Service Expansion	Modify SBCAG Model 's Commuter Rail Option (101 IM CR Package Option) during AM and PM periods;; Run Model	Not applied	Latest analysis from CSMP Report indicates that commuter friendly rail service would result in one-half the vehicle trip reduction (285 instead of 385) as estimated by 101 In-Motion Study.	Assumed future re-scheduling and/or adding new State supported Surfliner train service that caters to commuters would result in vehicle trip reduction level back to 385.
Employment growth reduction and realignment	101 In Motion Test of employment reduction and densification	No	Not studied	Full implementation of more concentrated and lower rate of employment growth in Goleta area

## Inter-Regional Transit Services Expansion and Assumptions

This section analyzes how fixed route and commuter transit services in Santa Barbara County may expand from now through 2040. The purpose of this analysis is to develop the transit expansion assumptions for application in the SBCAG travel demand model. In general, this analysis assumes the following:

- No changes to the general configuration of any transit system
- Any transit expansion will increase frequency on existing routes rather than add new routes
- Frequency on routes with high ridership volumes, e.g., trunk routes, and express routes, are doubled, to the extent possible
- For local services, expansion assumptions were based on bus purchases included in the 2009 RTP.

Expansion of b inter-regional and local transit services are included in this analysis, Inter-regional services include Clean Air Express, Coastal Express, and Valley Express. Local transit services include the Santa Barbara Metropolitan Transit District (MTD), Santa Maria Area Transit (SMAT), City of Lompoc Transit (COLT), Santa Ynez Valley Transit (SYVT), Guadalupe Transit (Flyer and Shuttle). Demand response and other newer or irregular inter-community transit services such as Breeze, Wine County Express, Cuyama Transit, Easy Lift, and SMOOTH. These services were not incorporated in the 2007 model calibration. In addition, for purposes of this analysis, staff created vehicle blocks to determine the number of buses needed for various frequencies. Below is an example, Transit X currently runs a 50-minute loop with 60 minute frequency. Transit X can run this schedule with only one bus:

Block Number	Depart Transit Center	Return to Transit Center
1	6:15 AM	7:05 AM
1	7:15 AM	8:05 AM
1	8:15 AM	9:05 AM
1	9:15 AM	10:05 AM



If Transit X decreases headways to 30 minutes, it will need two buses:

Block Number	Depart Transit Center	Return to Transit Center
1	6:15 AM	7:05 AM
2	6:45 AM	7:35 AM
1	7:15 AM	8:05 AM
2	7:45 AM	8:35 AM

If Transit X decreases headways to 15 minutes, it will need four buses:

Block Number	Depart Transit Center	Return to Transit Center
1	6:15 AM	7:05 AM
2	6:30 AM	7:20 AM
3	6:45 AM	7:35 AM
4	7:00 AM	7:50 AM
1	7:15 AM	8:05 AM
2	7:30 AM	8:20 AM

## Regional and Interregional Transit Services Expansion Analysis

### Clean Air Express:

The Clean Air Express (CAE) offers weekday-only fixed-route commuter bus service from Lompoc to Goleta/Santa Barbara and from Santa Maria to Goleta/Santa Barbara. In the 2009 RTP, the Clear Air Express service was based on the 2007 schedule. In 2007 the CAE offered 11 routes, six from Lompoc and five from Santa Maria. The CAE increased service to seven routes from Lompoc in 2008.

The CAE is expected to increase service from 12 weekday routes to 13 by 2020, adding one route from Santa Maria. By 2030 a total of 14 routes are expected, with eight from Lompoc and six from Santa Maria.

### Coastal Express:

The Coastal Express is an inter-regional bus service jointly managed and funded by the Ventura County Transportation Commission (VCTC) and SBCAG. It offers daily service between Oxnard, Ventura, Carpinteria, Santa Barbara, and during peak hours, Goleta and UCSB.

In 2007, the Coastal Express offered 14 northbound and 17 southbound trips with most of the service offered during peak hours. Between 2007 and 2010, Coastal Express has improved its service significantly, now operating 24 northbound and 27 southbound trips. Ridership increased 50% between 2007 and 2009.

For the purposes of modeling the 2035 vehicle trips and VMT emissions reduction benefits under the "ambitious and achievable" approach, the following assumptions were made for 2035:

- Assumed two additional services each direction for 2020 to 26 NB and 29 SB services
- Assumed four additional services each direction for 2035 to 28 NB and 31 SB services

### Valley Express

The Valley Express offers fixed-route commuter service from the Buellton and Solvang to Goleta and Santa Barbara. Every weekday morning two buses leave Solvang at 6:15 AM and one bus leaves at 6:33 AM.

It is unlikely the Valley Express will be expanding. Ridership has fallen; service was cut from four routes to three in 2008 and may be cut from three routes to two in 2010. The service will likely be absorbed into the Clean Air Express within the next few years. Thus, no service expansion is assumed.

#### Breeze:

It offers fixed-route commuter service between Santa Maria, Vandenberg Air Force Base, and Lompoc. It does not operate on consistent headways. It departs Santa Maria at 5:45 AM, 6:20 AM, 9:50 AM, 12:45 PM, 3:20 PM, 3:55 PM, 4:45 PM, and 5:20 PM. It departs Lompoc at 6:15 AM, 6:45 AM, 8:45 AM, 11:45 AM, 1:45 PM, 3:45 PM, 4:20 PM, and 5:30 PM. The trip between the two cities takes just under an hour. By 2020 the Breeze will likely add Saturday service and may also increase service to provide one-hour headways all day. The Breeze may also provide service between Santa Maria and the Santa Maria Valley by 2020.

The Breeze started the service in 2008/9 and therefore was not incorporated in the Transit Model network. For purposes of consistency modeling, Breeze was excluded in this analysis.

#### Wine Country Express

The Wine Country Express began operating in August 2008. It provides weekday fixed-route service between Lompoc and Buellton/Solvang. The bus departs from Lompoc at 7:25 AM, 1:00 PM, and 4:45 PM, and from Solvang at 8:10 AM, 1:40 PM, and 5:25 PM. The Wine Country Express will likely increase frequencies to provide service similar to the Breeze. It may provide one-hour headway all day by 2020.

This transit service was not incorporated in this analysis since the service was not incorporated in the 2009RTP and therefore is excluded in this analysis.

### Local Transit Services Expansion Analysis

#### Santa Barbara Metropolitan Transit District (SBMTD)

MTD operates 50 local/regional fixed routes (including 23 school booster routes, and counting the Downtown-Waterfront Shuttle as one route). MTD also operates three Valley Express routes and one Clean Air Express route (see below for more information). MTD maintains ridership data by route. The MTD routes with the highest annual total ridership, in order, are

- 5: 11 (State/Hollister/UCSB)
- 2: 6 (State/Hollister/Goleta)
- 3: 2 (Eastside)
- 4: 1 (Westside)
- 5: 24X (UCSB Express)
- 6: 30 (one of the Downtown-Waterfront Shuttle routes)
- 7: 20 (Carpinteria)

According to the capital improvement plan in the 2009 RTP, MTD plans to purchase three expansion diesel buses, three expansion hybrid buses, and four expansion electric buses in 2007 (MTD 2). MTD also plans to purchase an undisclosed number of buses for expanded service in 2015 at a cost of \$6,843,000 (MTD PL 17).

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<sup>5</sup> Based on 2007-08 ridership data

For the purposes of this analysis since the RTP assumed an urban bus costs approximately \$320,000 in 2007 dollars, and the RTP also assumed a 4% cost inflation rate, \$6,843,000 in 2015 equates to approximately 16 buses.

Since Line 24X is an express route, is on both the highest total ridership list and highest ridership per revenue hour list, and has headways of approximately 30 minutes, staff would expect it to be a priority for expansion. With two additional buses, Line 24x could run 15-minute headway.

Line 12x (Goleta Express) is also on the highest total ridership list. Line 12X could also run 15 minute headways with two additional buses.

Another MTD express route is Line 21x (Carpentaria Express). Although Line 21x does not have high ridership, another long-distance route to Carpentaria, Line 20, does. An additional three buses would allow Line 20 to operate with 15-minute headway.

MTD's only other express route is Line 15x (SBCC/UCSB Express). Line 15X does not have high ridership, but two other routes that serve SBCC, Lines 16 and 17, do.

With two additional buses, Line 16 could decrease headway from 30 to 10 minutes. With four additional buses, Line 17 could decrease headway from 30 to 10 minutes. Note that this would also decrease the headways on Line 4 since the two routes are interlined. The remaining three buses could be used to increase frequencies on Lines 6 and 11. Other upcoming projects that may impact MTD's service include the construction of an Upper State Street Transit Hub (MTD PL 6), a Rail Transit Connection (MTD PL 13 & 14), and a Downtown Transit Center (MTD PL 22).

While these projects are in the RTP, insufficient information and project commitments exist at this time to examine how these projects will impact the existing bus routes. The following table summarizes the frequency expansion for SBMTD routes.

SBMTD Routes	Headway (Min)	
	Current	Expanded
1 Westside	10	10
2 Eastside	10	10
4 SB City College / Mesa	30	10
6 State/Hollister/Goleta	20	15
11 State/Hollister/UCSB	20	15
12X Goleta Express	30	10
16 SB City College	30	10
17 Westside/SS City College	30	15
20 Carpentaria	30	15
21X Carpentaria	30	15
24X UCSB Express	30	15

#### Santa Maria Area Transit (SMAT)

SMAT operates 23 local fixed routes, as well as ADA service. SMAT also operates the Breeze (see below for more information). SMAT maintains ridership data by route. The routes with the highest annual total ridership, in order, are (2):

- 1-A (S. Broadway/Orcutt)
- 20 (N. Broadway/Western Ave/Cook)
- 1-B (S. Broadway/Orcutt)
- 2 (N. Broadway/Railroad Ave/Cook)
- 3 (E. Main/Suey/Donovan/Miller)
- 3P (E. Main/Panther/Donovan/Miller)
- 7 (Bradley Road)

According to the RTP, SMAT plans to purchase five urban buses for limited stop express service in 2010 (SMAT PL 1); and 20 urban transit buses for enhanced peak period local service in 2010 (SMAT PL 11).

SMAT could increase frequency from 60 minutes to 30 minutes on Routes 1-A and 1-B with two additional buses, to 20 minutes with six additional buses, to 15 minutes with eight additional buses, and to 10 minutes with 14 additional buses.

SMAT could use two buses to decrease headway on Route 20 from 30 minutes to 10 minutes, two buses to increase frequency on Route 2 from 30 minutes to 10 minutes, two buses to increase frequency on Route 3 & 3P from 30 minutes to 10 minutes, two buses to increase frequency on Route 7 from 30 minutes to 10 minutes, and three buses to increase frequency on Route 4 from 60 minutes to 15 minutes.

Other upcoming projects that may impact SMAT's service include the construction of a SMAT Transit Center (SMAT 1) and the design and construction of existing property adjacent to current maintenance and operating facility to increase bus staging capacity (SMAT PL 9). Because the new transit center is under construction at this time, it is assumed that all routes will be redirected from the existing Town Center Mall transfer point to the new transit center by 2015.

Current frequencies on the most heavily used routes are as follows:

Santa Maria Area Transit (SMAT) Routes	Headway (Min)	
	Current	Expanded
1-A (S. Broadway / Orcutt)	60	30
1-B (S. Broadway / Orcutt)	60	30
2 (N. Broadway / Railroad Ave / Cook)	30	10
20 (N. Broadway / Western Ave / Cook)	30	10
3 (E. Main / Suey / Donovan / Miller)	30	10
3P (E. Main / Panther / Donovan / Miller)	30	10
4 (Thornburg / Crossroads)	60	5
7 (Bradley Road)	30	10

#### City of Lompoc Transit (COLT)

COLT currently operates six local fixed routes (1, 2, 2A, 3, 4, and 5), ADA service, and a twice-weekly shuttle to Santa Barbara. It also operates the Wine Country Express (see below for more information). Current headway on COLT's local fixed routes during AM peak hours are 30 minutes on routes 1, 2, 2A, 3, and 5, and 60 minutes on route 4. COLT does not maintain ridership data by route.

COLT plans to purchase two new buses every five years (COLT PL 2). For this analysis staff assumed COLT will first want to increase the 60 minute frequency on route 4, and then the frequency on Route 3 since it is essentially the only east-west route.

Staff assumed 2 and 2A would be the next priority; the fact that there was sufficient ridership to warrant two routes running the same loop in opposite directions indicates the routes are heavily traveled. Thus the expansion is estimated to be as follows:

2010:	increase frequency on Route 4 from 60 to 30 min
	increase frequency on Route 3 from 30 to 15 min
2015:	increase frequency on Route 2 from 30 to 15 min
	increase frequency on Route 2A from 30 to 15 min
2020:	increase frequency on Route 1 to from 30 to 10 min
	increase frequency on Route 5 from 30 to 15 min
2025:	increase frequency on Route 4 from 60 to 15 min (would require 2 add'l buses)
2030:	increase frequency on Route 3 from 30 to 10 min
	increase frequency on Route 5 from 30 to 10 min
2035:	increase frequency on Route 2 from 30 to 10 min

2040: increase frequency on Route 2A from 30 to 10 min  
increase frequency on Route 1 from 30 to 5 min (would require 2 add'l buses)

However, for purposes of modeling, it is assumed that the transit service expansion is going to ambitiously and achievable by 2035 and that Routes 1, 2, 2A, 3, 4 and 5 to be as follows, and that the expansion of service frequency would be expected to be 50% of the service expansion as 2035. The following table summarizes the model assumptions.

City of Lompoc Transit Routes (COLT)	Headway (Min)		
	Current	2020 Expanded	2035 Expanded
Route 1	30	10	5
Route 2	30	15	10
Route 2A	30	15	10
Route 3	30	15	10
Route 4	60	30	15
Route 5	30	15	10
Santa Barbara	Twice Weekly	No Change	10

Two other upcoming projects that may impact COLT's service include the construction of a Downtown Transit Transfer Center (COLT PL 3) and a Transit Operations Center (COLT PL 4). While these projects are in the RTP, insufficient information and project commitments exist at this time to examine how these projects will impact the existing bus routes.

#### Santa Ynez Valley Transit (SYVT) and Guadalupe Transit (Flyer and Shuttle)

SYVT operates two fixed routes, A and B that travel essentially the same loop in opposite directions. Current headways on routes A and B are 1 hour and 20 minutes. SYVT does not maintain ridership data by route. SYVT plans to purchase a new bus every five years (SYVT PL 2). The expansion estimate is as follows:

2010: decrease headways on Route A from 80 to 40 minutes  
2015: decrease headways on Route B from 80 to 40 minutes  
2020: decrease headways on Route A from 40 to 30 minutes  
2025: decrease headways on Route B from 40 to 30 minutes  
2030: decrease headways on Route A from 30 to 20 minutes  
2035: decrease headways on Route B from 30 to 20 minutes  
2040: decrease headways on Route A from 20 to 15 minutes

Guadalupe Transit includes the Guadalupe Shuttle and the Guadalupe Flyer, as well as ADA service. The Guadalupe Shuttle is essentially a demand response service. Current headway on the Guadalupe Flyer is 60 minutes.

Guadalupe Transit plans to purchase a new bus every five years to cover both expansion and replacement (Gu PL 4). Staff assumed Guadalupe Transit would alternate the bus purchases between expansion and replacement. Staff also assumed some expansion buses would go toward decreasing headways on the Flyer and some would go toward the Shuttle. Thus the expansion estimate is as follows:

2010: increase Flyer frequency from 60 to 30 minutes  
2020: increase Flyer frequency from 30 to 20 minutes  
2030: add a bus to the Shuttle  
2040: increase Flyer frequency from 20 to 15 minutes

Santa Ynez Valley Transit (SYVT)	Headway (Min)		
	Current	2020 Expanded	2035 Expanded
Route A	1 hr. 20 min.	30	20
Route B	1 hr. 20 min.	30	20
Guadalupe Transit			
	Current	2020 Expanded	2035 Expanded
Flyer	60	20	15
Shuttle	Demand Response	No Change	15

### **Park & Ride Facility Improvements**

Based on existing lot utilization, the existing park & ride (P&R) facilities within Santa Barbara County reduce approximately 385 trips per day (see **Table A5**). This figure is based on vehicle counts conducted during 2009 site visits. This trip reduction coupled with an estimate of average trip distance equates to a reduction of approximately 11,556 daily VMT.

**Table C5: Estimation of Current Vehicle Trips and VMT Reduction Resulting from Park & Ride Lots (2009)**

City	Park & Ride Lot	Daily Vehicle Trips (One Way)	Avg. Trip Distance (Round Trip) 1/	Est'd Daily VMT Reduced
Buellton	Avenue of Flags (south) 2/	0	75	-
Lompoc	Ocean Lanes Bowling Alley	24	94	2,256
Lompoc	Clean Air Express P&R Lot 2/	0	96	-
Orcutt	Clark Avenue NE/135	14	129	1,806
Orcutt	Clark Avenue NW/135	21	129	2,709
Orcutt	Clark Avenue SW/101	25	124	3,100
Santa Barbara	Carrillo Lot	93	1	93
Santa Barbara	Cota Lot	196	5	980
Santa Maria	Clean Air Express P&R Lot 2/	0	132	-
Santa Ynez	Santa Ynez-246/154	12	51	612
<b>TOTAL</b>		<b>385</b>		<b>11,556</b>

1/ Measured from the P&R lots to an assumed centralized location between Goleta and Downtown Santa Barbara.

2/ Avenue of Flags (south) lot is excluded to avoid double counting trips reduced by transit (Valley Express). Clean Air Express lots are excluded to avoid double counting trips reduced by transit (Clean Air Express).

A preliminary review of the survey results indicates the public has expressed a need for additional P&R facilities. SBCAG is in the process of preparing a Park & Ride report and several potential locations for new P&R facilities have been identified (see **Table A6**). Assuming these facilities are developed by 2035, and will each serve approximately 20 users (the average number of vehicles served by Santa Barbara County's P&R facilities, excluding Clean Air Express (CAX) lots and peripheral South County lots), these lots will help reduce an additional 140 trips. Consequently, a total of approximately 551 daily vehicle trips or 24,688 VMT would be reduced by 2035.

**Table C6: Estimation of 2035 Vehicle Trips and VMT Reduction Resulting from Park & Ride Lots (2035)**

City	Potential Future Park & Ride Lot	Daily Vehicle Trips (One Way)	Avg. Trip Distance (Round Trip) 1/	Est'd Daily VMT Reduced
Buellton	Avenue of Flags (north)	20	75	1,500
Carpenteria	Bailard & 101	20	37	740
Lompoc	Home Depot	20	93	1,860
Lompoc	TBD (north side of town)	20	99	1,980
Orcutt	UVP/135	20	131	2,620
Orcutt	UVP/101	20	129	2,580
Santa Maria	101/135	20	141	2,820
Estimated trips reduced at existing P&R lots in 2035 2/		411		10,588
<b>TOTAL</b>		<b>551</b>		<b>24,688</b>

1/ Measured from the P&R lots to an assumed centralized location between Goleta and Downtown Santa Barbara.

2/ Assumes a compounded growth of 0.5% per year. The Ocean Lanes Lot in Lompoc is excluded due to future redevelopment.

## Expansion of Commuter Friendly Rail Service (Surfliner) between Ventura and Santa Barbara/Goleta

### CSMP "Commuter Friendly Rail Service Assumptions"

The 101 In-Motion Report evaluated additional commuter-friendly passenger rail service between Oxnard and Goleta for 2030. The analysis tested two additional northbound trains in the AM peak commute period and two additional trains in the PM peak commute period servicing the existing Amtrak stations located in Goleta, Santa Barbara, Carpinteria, Ventura, and Oxnard. The current schedule shows northbound trains arriving in Santa Barbara at 7:40AM and 8:45 AM southbound trains would leave at 4:35 PM and 5:25 PM. The 2030 ridership forecasts estimated the passenger rail would generate 460 boardings and alightings per average weekday. Based on an estimated average vehicle occupancy rate in the peak commute period of 1.2, ridership forecasts translate to a vehicle trip reduction of 385 northbound trips in the AM peak commute period and 385 southbound trips in the PM peak commute period.

The vehicle-trip reductions in the 101 In-Motion Report and commuter Rail Assessment Report were estimated based on a passenger rail service like Metrolink. The draft CSMP, "US101 Transit and TDM scenario," assumed a modified version of the Amtrak Intercity Pacific Surfliner Rail service. SBCAG staff recommended that the 101 In-Motion Report vehicle trip reductions be re-estimated to reflect Amtrak pricing and reliability. The preparers of the CSMP determined that Amtrak pricing is approximately 15% more than Metrolink pricing for the 10-ride pass and the monthly pass. The Journal of Public Transportation, Vol. 7, No. 2, 2004 suggests a price elasticity of -0.6 to -0.9 over a five to ten-year period. Assuming a midpoint, a price elasticity of -0.75 reduces the forecasted vehicle trip reductions by 11.3%. Existing analysis also shows Metrolink service to arrive on-time more frequently than Amtrak service. A case study in Chicago attributed a ridership increase of 16.7% based on better service reliability. These two factors were combined in full to estimate that the modified Amtrak service would generate a 285 vehicle trips reduction (73.9% of what was assumed in the 101 In-Motion report. For the "ten Year after CMA Opening: CSMP US101 enhanced Transit and TDM scenario, vehicle-trip tables were reduced by 285 northbound trips in the 7 to 9 AM period and 285 southbound trips in the 4 to 6 Pm period.

Under the "ambitious and achievable" approach, Scenario B further assumes that re-scheduling and/or adding new State supported train service, to cater to commuters between Ventura and Santa Barbara during AM and PM peak periods, would result in additional commuter riders and that the total vehicle trips reduction resulting from increase commuter friendly rail service (Surfliner) could reduce 385 vehicle trips as originally predicted by the 101 In-Motion study.

### 101 In Motion: Effects of reduction in growth and increased density of employment on regional travel

Another aspect of the 101 In Motion Study was a test of the sensitivity of employment growth and land use pattern changes on travel demand. Would a significant reduction in employment growth and a change in the distribution of that growth eliminate the need for a freeway widening east of Santa Barbara? Staff used this study as an example to investigate its potential impact on GHG emissions reduction.

From the outset of 101 In-Motion Study it was recognized that solving the congestion problem in the corridor will take a combination of capacity enhancement and modal options supported by an array of ridesharing, transportation demand management and transportation system operational improvements. In addition, it was recognized that complementary land use policies are essential for encouraging trip reduction and a shift to alternative modes of travel.

A subcommittee of the technical and citizens advisory committees was convened to perform a "sensitivity" analysis to address the effect land use changes might have on transportation needs. The purpose of this effort was to assess if major changes the overall rate and distribution of growth could impact traffic growth patterns and if these changes in traffic growth could impact the need for infrastructure improvements.

The Alternative Land Use scenario that was hypothesized by the subcommittee was a significant departure from the present regional growth forecast in that it assumed that there would be no further

increases in vacant land devoted to housing or employment, rather jobs would increase based on increased density at existing job sites and household population would increase based on more people per household. In addition, the increases in population and employment would be substantially less (approximately 75 percent less) than assumed in the SBCAG 2002 Regional Growth Forecast (2000–2030).

While the SBCAG 2002RGF estimates an increase of approximately 47,000 jobs and 8,000 housing units in the South Coast between 2000 and 2030, the Alternative Land Use Scenario assumed just 12,000 new jobs and no new housing units. Approximately 8,700 new jobs would result from density increase. Employment due to pending and approved projects (620 new jobs) as described by the "County Open Lands Report" was also added for a grand total of 9,320 new jobs. The original South Coast year 2030 employment forecast estimated 47,000 new jobs, so this reflects an 80 percent reduction in forecasted employment growth.

The following are the findings of this modeling exercise:

- These revised assumptions about future growth were fed into the regional travel model. The results of this analysis indicated that while the existing congestion problem in the eastern portion of the Highway 101 corridor would not be alleviated, a significant reduction in new development occurring in the west end of the corridor may forestall the need for major highway capacity improvements in the Goleta area.
- The forecasts showed that during the PM Peak, Highway 101 between Milpas to Ventura County line would still expect to be congested (in LOS E/F range) since the 2030 Alternative Land Use Scenario would reduce the traffic growth on Highway 101 by approximately 2 to 4 percent in this segment of the freeway.
- In contrast, congestion on Highway 101 in the Goleta area could be expected to improve by at least one service level (from LOS E/F to LOS D/E). This is because traffic growth on Highway 101 between Milpas and Turnpike with the Alternative Land Use Scenario was forecast to drop 5 to 7 percent when compared to the 2030 Base Case forecast.

The most notable reduction of traffic growth on Highway 101 (approximately 20 percent) would occur between Patterson Avenue and Glen Annie/Storke Road.

Since the greatest amount of development potential in the South Coast is in the west end of the Highway 101 corridor, this area has the potential to be most significantly affected by significant changes in future land use. In addition, one conclusion that can be drawn is that significant changes in local build out potential in land use plans could significantly affect the extent and timing of the need for new infrastructure improvements in the western portion of the corridor. This issue will be examined countywide with the development of the Sustainable Communities Strategy required by SB-375.



## **SCENARIO C: Pricing and Disincentives Alternative**

### **Parking Pricing: An Example Using "Plan Santa Barbara Public Parking Pricing Policies"**

The ongoing update of the Santa Barbara General Plan, PlanSB (draft) is examining a policy provision that intends to reduce employee parking demand in the downtown Santa Barbara area. The policy provision contains the following provisions:

- Eliminating the "75-min free parking" for on-street/curb spaces, thereby eliminating the "75-minute shuffle" for downtown employees, and considers implementing paid parking on an hourly basis (\$0.33/hr for PlanSB Alternative and \$0.61/hr for Alternative 2).
- Eliminating parking discounts (e.g. first 75 minutes free) in off-street lots and charging tiered rates based on length of stay and time of day (e.g. higher rates during peak hours)
- Implementing "smart" parking strategies such as on-street smart meters that can respond to vehicle user's payment via credit card or cell phone and way-finding technology that provides real-time parking demand and directs travelers to under-utilized lots.

#### *Data Source and Analysis*

Quantification of vehicle trip reduction related to the public parking pricing policy is contained in the Fehr & Peers technical memorandum Future Traffic Conditions for the 2030 Proposed Project PlanSB Scenario, November 2009. (Ref: [2253 - Future Project \(PSB\) Revised Final Travel Volume Forecast Memo.pdf](#).) The PlanSB Trip Reduction Impacts Analysis was prepared in a memo in the Appendix by Nelson/Nygaard in July 2009<sup>1</sup>.

Within the analysis, Nelson/Nygaard, consultant to the PlanSB project, establishes a vehicle trip reduction factor based on the daily parking price using ITE Studies conducted by Comsis Corporation, and Victoria Transport Policy Institute. Those studies identified travel characteristics for three different types of communities, 1) Low-density suburb, 2) Activity Center, and 3) Regional central business district (CBD)/corridor. The studies then identified vehicle trip reduction factors for parking pricing for each of the three different communities, as shown in the table below. Nelson/Nygaard concludes that the City of Santa Barbara most closely resembles an "Activity Center" for the purposes of the analysis.

#### *Vehicle Trip Reductions by Daily Parking Fee*

Worksite Setting	\$1.49	\$2.98	\$4.47	\$5.96
Low Density Suburb	6.5%	15.1%	25.3%	36.1%
Activity Center	12.3%	25.1%	37.0%	46.8%
Regional CBD/Corridor	17.5%	31.8%	42.6%	50.0%

Source: Land Use Impacts on Transport, Victoria Policy Institute

The "PlanSB" Scenario 1 assumes a daily parking charge for off-street parking of \$2.98 or \$0.33 per hour. As shown in the table, parking pricing set at this rate would reduce downtown employee vehicle trips by a factor of 0.251 (25.1%). Alternative 2 (the "more housing" alternative) assumes a daily on-street parking charge of \$5.52 per day or \$0.61 per hour. Using the formula derived from the table above, this price would reduce employee vehicle trips within the downtown area by a factor of 0.442 (44.2%).

#### *Post-Processing for GHG Reduction using the SBCAG Model*

In order to account for the GHG reduction for parking pricing of PlanSB, the SBCAG's model data and forecast were derived using the following post-processing procedure:

- Determine the number of workers employed in Downtown Santa Barbara Area Types 1 & 2 by SBCAG model TAZ based on the employment forecast for 2005Base Year, 2020 interim and 2035 horizon years
- Determine the number of vehicle trips and average trip lengths per day by employees in the selected downtown area
- Compute the "baseline" vehicle trips and VMT for the "downtown employees" assuming existing pricing conditions.
- Calculate the VMT reduction associated with the parking pricing policy in PlanSB and apply the 0.442 "trip reduction factor" under PlanSB Alt. 2 approach and 0.251 "trip reduction factor" under PlanSB Alt. 1 approach.

The following are VMT and GHG reduction benefits were quantified:

- Assuming the parking policy provisions under PlanSB Alt. 1 were to be implemented, a total of 97,700 VMT would be reduced in 2035, reflecting approximately 0.6% of GHG reduction per Capita.
- Assuming the parking policy provisions under Plan SB Alt. 2 were to be implemented, a total of 172,000 VMT would be reduced in 2035, reflecting approximately 1.0% of GHG reduction per Capita.

Table C7 summarizes the VMT and CO2 reduction results as an example for Scenario C – Pricing and Disincentives.

**Table C7: Parking Pricing Policies on VMT Reduction (PlanSB Example)**

Scenario C: Parking Pricing (SB Areas 1&2 only)	PlanSB Parking Pricing Policies - VMT Reduction Estimation						
	# Employees in SB Area Types 1 & 2	Total Vehicle Trips Modeled	Avg. Trip Length 1/	VMT with no Parking Pricing Implemented	Trip Reduction Factors	VMT Reduced (Rounded)	CO2 Reduction per Capita (with Pavley Adj.)
2005 Base Year	48,743	58,408	6.0	350,448	not applied	0	0
2035 PlanSB (Alt 1)	56,333	64,871	6.0	389,226	0.251	97,700	0.6%
2035 PlanSB (Alt. 2)	56,333	64,871	6.0	389,226	0.442	172,000	1.0%

1/ An average trip length for home-based-work trips from the SBCAG model is used.

It should be noted that the PlanSB Parking Pricing policies is only a draft proposal that has yet to receive the input from the City Council of Santa Barbara, business communities, and the general public. While the PlanSB parking pricing strategies implemented in Downtown Santa Barbara appears to have the greatest reduction in vehicle trips and VMT, the PlanSB Report has indicated that "such a policy would also have economic ramifications... Therefore parking pricing strategies must be carefully designed to contribute to the economic vitality of Downtown (Santa Barbara)..., decision makers must determine the appropriate balance between future congestion levels and the aggressiveness of the City's travel demand strategies."

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<sup>1</sup> Plan Santa Barbara Trip Reduction Impacts Analysis, Nelson/Nygaard Consulting Associates, July 2009